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THE TELEPHONE CONVENTION.

The convention which has just finished its sitting at Detroit, was in some ways an unexpected success. It developed conclusively the fact that there is a widespread desire for union on the part of the independent exchange companies and that they are almost unanimous in their ideas as to the best means for securing an effective consolidation of their interests.

The convention was marked by an air of businesslike earnestness. While many points that were raised were discussed at length and even with heat, there was at no time even a tendency displayed to split the convention or to make its action ineffective. That its action was effective is a fact which will certainly have to be reckoned with in future.

It was in many respects a remarkable gathering. Consisting, as it did, of men from all sections of the country, no two surrounded by precisely the same conditions, the unanimity of opinion and desire exhibited by the delegates was truly marvelous. The character of the men themselves was well displayed by the constitution which they finally adopted. This vigorous document is a strong bond of union between those who have subscribed to it. While it is not, perhaps, perfect, it forms, at any rate, the basis for what will be a strong working organization.

It is pleasant to be able to record the fact that the convention was an entire success. Indeed, it succeeded beyond the expectations of many who went to Detroit. It is too early as yet to predict fully the final outcome of the action taken there, but there is no doubt that the new association can make a formidable showing either in defense or offense.

The next meeting of the association will probably be held in the Eastern States, and will unquestionably show that much good work has been done in the interim. At present the main strength of the independent telephone movement seems to lie in the central part of the country. It is to be hoped that by next June it will be possible to chronicle a great extension, both of the exchanges themselves and of interest in the movement which they represent, in the East.

The officers and advisory board are men of wide knowledge of business and legal affairs and are apt to prove themselves determined and aggressive in the conduct of the affairs of the association. One does not need to look far into the future to predict the ultimate success of any movement which they undertake, backed as they are with the financial and moral support of a large number of active and intelligent corporations. The great strength of the independent movement, however, lies in the fact that the individual companies are each entrenched in a perfect citadel of public opinion, and that collectively they have the good wishes and may count upon the assistance of a very large part of the business community of this country.

VOLUNTEER CORPS OF ELECTRICAL ENGINEERS.

The announcement is made in our English letter this week of the official authorization of the organization of a corps of electrical engineers to form a part of the national defense of England. The

idea was first suggested by Dr. John Hopkinson, and on being brought to the attention of the War Office received the favorable consideration of the military authorities with the result above noted. In acknowledgment of the prominent services rendered by Dr. Hopkinson in this connection he has been appointed commanding officer of the corps, and Lord Kelvin has been enrolled as an honorary colonel.

The rank and file of the electrical corps will be recruited from electrical artisans and similar trades, while the officers and non-commissioned officers will be selected mainly from among the members of the Institution of Electrical Engineers. The important part occupied by electricity in military and naval operations naturally elevates this branch of national defense to a plane where it has become specialized, requiring the employment of specially trained persons for the proper performance of the duties imposed upon such service. An electrical corps, therefore, occupies an exceedingly important position in relation to military and naval operations in times of war, and that the idea has taken a concrete form is but a step in the process of evolution that is now going on in the science of national defense.

Any government with such a corps in its service will necessarily have at its command the best talent available in this particular line, and the service itself, moreover, will tend to draw to it the highest skill, more for the honor than for any emolument that may attach to the positions.

The only regret that we entertain in this connection is that the idea did not originate in America. The fact that it did not, however, is no reason why a similar movement should not be initiated in this country and carried out to its full fruition.

CABLE ROAD RUNAWAYS.

On Tuesday, June 22, the Broadway cable road was again put into an entirely inoperative condition for some time owing to a stranded cable which caught in the grip of one of the up cable cars at Eighth Street and Broadway, carrying that car, with a gradual addition of six others in front, to Fifteenth Street, before the cable-operating engines at the Fiftieth Street power house were stopped. The consequent loss of time necessary to repair the damaged cable caused a block along the entire route. Notwithstanding the fact that a signaling system with boxes located at intervals along the line has been specially installed in order to afford rapid and easy communication with the power house in such cases, and provide against any continued operation of the system under such conditions, not one of the company's representatives seemed to be sufficiently quick-witted to take advantage thereof until the cars had traveled uncontrolled over a quarter of a mile of the road and rounded the deadly curve at Fourteenth Street.

Unquestionably such occurrences could be entirely eliminated by the adoption of an electric system. While the cable system is still in operation, and perhaps will be for some years to come, every conceivable means should be used to prevent such accidents. Only good luck prevented a fatal termination to this one. It seems that there are various methods whereby it is possible to signal directly from the car platform to the power house. Various other methods will also at once present themselves to one who is familiar with electric signaling, whereby such results may be accomplished. It would seem possible to adopt a method of this kind, and combine with it the present signaling system, so that the motorman, as soon as he noticed any difficulty with his gripping apparatus, could at once signal from the platform of his car, and not rely upon any outsider to run to the signal boxes, which are at times inaccessible. The signaling apparatus could also probably be arranged to work automatically in case the gripping apparatus failed to operate properly, and could perhaps be combined with the valve gear of the power engine. Some such system it would seem would form a highly valuable addition to the present signaling arrangements, and could probably be installed at a very small cost.

ARE THERE TOO MANY INSPECTION BUREAUS?

While the inspection of electrical installation work has unquestionably proven a most valuable feature in the development of this branch of electrical industry, it seems from a careful examination of the present methods that the tendency is rather toward too much inspection than toward too little. Aside from the inspections made by the various underwriters' bureaus, most large cities also have a municipal inspection bureau, and, in addition to these, inspections are also made in the cities of the larger class by the illuminating companies. In some instances there are others, and in this city installations are sometimes examined by as many as five different inspectors, each of whom has his own particular ideas, and is working under the direction of rules which are frequently at variance. All this is of great disadvantage to the contractor, who is often at his wits' end to know exactly what to do in order to install the work so as to comply with all regulations. Cases have been known where work has been installed under the rules of one bureau, such work being in violation of the rules of another bureau, and the suffering contractor being compelled to entirely remodel the already-completed installation in order to bring it up to the second standard.

In view of the above, it would seem that there is a crying necessity for a standard inspection bureau which should be partly or entirely under municipal control, with one head and one code, thus making it possible for the contractor to know exactly what to do in every case. A bureau of this kind in large cities, particularly in New York, would undoubtedly result not only in great economy for those interested in such inspections, but also in greater uniformity in the character of the work installed, and perhaps somewhat increase the already extraordinary excellence of electrical installations in this city. Unquestionably the present bureaus have done much to accomplish this result, but, as in many other things, it would seem that consolidation would result in further improvements.

It is to be hoped, therefore, that the new rules which were recently approved by the National Electric Light Association, at the Niagara Falls meeting, will meet with general sanction. They unquestionably embody all that experience and well-matured knowledge have deemed necessary to the perfection of electrical installation work, and having been evolved by a body of men representing every possible interest affected by them, they should certainly be regarded as authoritative. Should these rules be generally adopted, the formation of a standard bureau would be an easy matter, as the various inspections would then simply be duplicates of each other.

Extending the Third Rail System on the N. Y. N. H. & H. R. R.

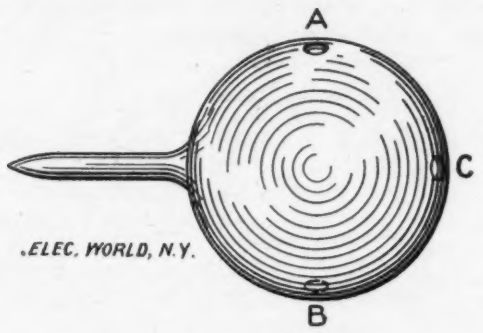
The new third-rail electric railway system operated by the New York, New Haven & Hartford Railroad Company is to be further extended by equipping another track in addition to the present single-track line between Berlin and New Britain. It is also intended to extend out to Bristol and Plainville, which are already connected by trolley lines with Hartford. In making these extensions the company has been guided by the excellent results, commercial and otherwise, obtained by the lines in operation.

The Effects of Röntgen Rays Upon a Beam of Light.

BY FRANCKE L. WOODWARD.

Some experiments were recently made by myself in relation to the effect of Röntgen rays upon a beam of light projected through a vacuum, and as the results appear to be of much interest, I send herewith an account of the same.

The accompanying illustration shows the form of tube used in carrying out the experiments. The tube is entirely coated with black paper, except at the points *A*, *B* and *C*, which are small circular openings one-half inch in diameter, the tube being exhausted to the highest state of vacuum. A calcium lamp was used, so covered with heavy black paper that only a circular beam of light one-quarter of an inch in diameter was projected from it. With the addition of a good Crookes tube, this apparatus is all that is required to proceed with the experiments, which must be conducted in a perfectly dark room. The Crookes tube must also be covered with black paper to prevent any visible fluorescence. Now, upon projecting a beam of light from the calcium lamp upon the vacuum tube at the opening, *B*, so that it shall emerge from the opening, *A*, and fall upon a black screen conveniently arranged, it will be found that the beam of light coming from *A* will not have more than one-twentieth the intensity of the same beam entering at the opening, *B*. On viewing the interior of the tube through the opening, *C*, the beam in crossing the interior vacuum is almost imperceptible. It would seem from this that if the vacuum were perfect, and no diffusion or reflection were possible, no light would emerge at the opening, *A*. Now, performing the identical experiment again, but having a powerfully-excited Crookes tube focused upon the vacuum bulb, it will be found that the beam of light emerging at *A* will have almost the same intensity that it has on entering at *B*. Repeating the experiment with tubes of different exhaustion, it will be found that the intensity of the emerging beam of light will be inversely as the degree of exhaustion, except when the Röntgen rays are focused upon the vacuum tube. This would seem to strongly support the theory of Tesla, who has claimed that the Röntgen rays are moving particles projected, for when the vacuum tube is traversed by the X-rays or rapidly projected particles, the beam of light is better able to traverse the intervening space, and certainly shows a remarkably interesting relation between the Röntgen rays and ordinary light.



VACUUM TUBE.

It has been suggested to me that no artificial means can produce a more perfect vacuum than that existing in interstellar space, that this affords a practically non-resisting medium for the transmission of light, and that it is inconceivable how any vacuum, unless it were a vacuum space in the other, could afford the slightest absorption to a beam of light.

The above suggestion has seemed true to me until my recent researches have led me to believe otherwise, and my results are confirmed by Prof. M. B. Snider, of the Franklin Institute, who recently in an address before that body is quoted as saying: "There is nothing in the Röntgen ray differing from what we call an electromagnetic ray. In time it will be possible to refract and reflect it and do anything with it that we can with light. Possibly what we term light in our atmosphere is nothing more than a transformation of energy out of the cathode rays shot off by the sun itself. Possibly light does not come from the sun at all."

He believes that the vibrations known as light are generated in the atmosphere. Were we to go up beyond the atmosphere, we would not see the sun at all.

A Speculation Regarding the Cause of Röntgen Rays.

BY ELIHU THOMSON.

Since so eminent a physicist as Prof. J. J. Thomson has in a recent paper put forward the hypothesis of the breaking down of what we have been accustomed to call the "elements" and has shown a reasonable basis for such a hypothesis, the writer deems it not improper to state that a similar view had quite independently arisen in his own mind, the origin and progress of which may, it is thought, be interesting to others working and thinking in the same field. No apologies are offered for indulgence in the speculations herein presented. They are not presented as scientific theories, demonstrable by appeal to facts, but may possibly aid in investigation, and they are, therefore, given for what they are worth.

For some years past the writer has felt that some light might be shed upon the nature and relations of the so-called elements could we attain exceedingly high temperatures by any means. The elements may have been evolved in the order of their complexity in a manner similar in some respects to the species of plants and animals.

About four or five years ago an experiment was planned as one possibly capable of permitting temperature far exceeding that of an electric arc, our present limit, to be obtained. A temperature of less than 4500° C above absolute zero is not high when it is remembered that there can be no upper limit assigned to possible temperatures. Our chemistry is now all confined, so to speak, within lower limits than 4000° C to 5000° C, and even within these limits most known compounds are decomposed or dissociated. Can we not raise our plane of temperature and give birth to a new chemistry in which the present elements, though apparently stable hitherto, shall become dissociated into simpler forms; for, that they are complex is to be inferred from the complex spectra which all, not excepting hydrogen itself, possess?

It was seen that the temperatures attainable by electric means were limited by the volatility and consequent expansion into vapor of the substances subjected to electric current, but that if the expansion could be prevented there might result the possibility of securing indefinitely high temperatures. To do this it was planned that a very strong and thick, but short, cylinder, of tempered steel, should have a small central opening through it so as to make it into a thick tube. This was to be lined with an insulating lining of some simple compound, as magnesia, for example, in a perfectly pure state. A core or wire of, say, metallic magnesium, was to pass through this, after which carefully-insulated heads or caps were to be very solidly clamped to cover the ends of the cylinder and form the terminals for the passage of an electric discharge. This would pass from head to head through the central core (wire of magnesium). This discharge was to be that of an enormous condenser charged by alternating currents furnished by a step-up transformer and the amount of energy to be delivered in a fraction of a second was to be made very large. The operation would be nearly instantaneous and should result in enormously high temperature of the material within the steel shell. There could be no expansion to lower the temperature. A spectroscopic examination was to be made of all the materials present before the experiment and a similar examination after the experiment should declare the presence of any element not there before. Reasoning on the idea that many complex compounds arise from sudden heating and cooling of comparatively simple compounds, it was thought possible that if dissociation of elemental forms took place at the enormously high temperatures the cooling would probably give rise to small amounts of the denser elements, discoverable, perhaps, by the spectroscope. These denser elements were to be the "elemental tars" or "polymers" of simple ones subjected to experiment. The experiment was to be varied in many ways. This general proposition was described to several associates at the time it was thought out. Among these are several well-known workers, such as C. P. Steinmetz, E. W. Rice, Jr., Robert Shand, and others. The plan was recognized as a basis for a possibly fruitful research. There was no opportunity to prepare for the work, and the idea was allowed to rest, in the hope that the future would yield the coveted freedom to undertake it. After two or three years the discovery by Röntgen of the peculiar radiation from the Crookes tube led to the writer's giving considerable time to investigation of the actions occurring, and probably as a consequence of the prior thought in relation to elemental dissociation,

the idea came that in the Crookes bombardment stream the conditions, upon collision with the platinum anode, must represent those of an exceedingly high temperature of the gas. With certain exciting apparatus of great power it was found that the bombardment was so energetic as to heat in a few seconds an anode plate one-sixteenth inch thick and an inch square to intense glowing heat. Considering the small mass of the molecules of gas projected from the cathode, the velocity of their movement was seen to be extremely great if they were to convey the energy delivered in so short a time to the platinum anode. The layer of gas immediately in front of the platinum must, it appeared, reach an extremely high temperature, and represent in a measure the conditions sought for in the proposed experiment with the steel tube above described.

The question arose: Could it be that the increase of vacuum was after all due to the formation out of the gas, of small amounts of denser materials, or even that the elementary gases were decomposed at the high temperature only to reform on cooling but with a small "tarry" residue, so to speak, polymers, perhaps, or denser, non-volatile elements? If this were so, then the gas should eventually all disappear in the same way. It does disappear, but how? We have guessed, but may be mistaken. We need to know more of it.

Considering these matters it occurred to the writer that a cause for the production of Röntgen rays might be found if the elements were dissociated into simple or more primordial matter. Taking the view, which has much to support it, that in the spectrum of ordinary heat and light we find all those rates of electric oscillation which characterize vibrating molecules or the atoms of elements composing them; that they set waves up in the ether because the ether is essentially electromagnetic; that the great rigidity of the ether, so opposed to its apparent extreme mechanical mobility, is after all only a chemical or electromagnetic rigidity, bearing no proportion to its mechanical properties, any more than the ordinary fluidity of a chemical compound bears to the chemical stability of the compound, we arrive at an interesting supposition respecting the Röntgen ray emanation. If the residual elementary gases are broken up into simpler and finer matter within the area of the bombarded spot, the normal electromagnetic rates of vibration of that finer matter should be far higher in pitch or of shorter wave lengths than in the case of the ordinary spectrum. According to this view there would be no oscillation so slow as ordinary light originating in the finer matter dissociated from the elements at the exceedingly high temperatures represented by the colliding molecules or atoms immediately at the front of the platinum anode. All the wave lengths emitted as normal to the new forms of matter, only existent at the highest temperatures, would be of the Röntgen ray order, and a spectrum of such rays might characterize the matter present, as the ordinary spectrum does the low temperature combinations. But absence of diffraction and refraction effects thus far are formidable obstacles to such analysis of these higher pitch rays.

The absence of the lower or Hertzian waves from sunlight probably depends on there existing no molecules or atomic aggregations in ordinary matter which can possibly vibrate electrically at such low rates. So in the hot primordial matter no ordinary light waves need be generated, but only the higher order known as Röntgen rays. The latter are the normal vibrations occurring in such matter. The spectroscope cannot help us in the analysis of these higher waves and the forms of matter giving rise to them. Further, if in the universe some of the hotter nebulae contain this ultra-elemental matter the eye will not discover it, and the air around the earth is too absorptive for these higher rays to penetrate it and reach us. A "fire mist" of primordial matter must remain invisible until some part cools sufficiently to form aggregations which we call elements, which are, perhaps, only extremely stable forms resembling in stability most of our known compounds at near absolute zero.

Admit the possibility of the view here expressed as a speculation merely, and it follows that there may be stars so hot interiorly as to possess only an outside layer of elements in the ordinary sense, while farther down within them are the black depths which shine only with the higher rays. Our sun has a low density, and if its interior, not subject to radiation loss, be of very much higher temperature than its exterior cloud of ordinary elements, a rift in the cloud might let out Röntgen rays which would produce electrical disturbances in the earth's outer atmosphere. Again, the mystery of the sun's supply of heat would be in part resolved. The heat given out in the formation of ordinary chemical compounds may be relatively very small compared with that yielded during the condensation of the ultra-elemental matter assumed into ordinary forms called elements under very powerful chemical or electrical forces. One can then conceive of a real photosphere surrounding the sun and begin to understand the meaning of those tremendous outbursts of activity connected with prominences and spots. Ordinary elementary forms arising by combination and cooling in the outer solar layers would precipitate themselves into the hotter dark interior to be violently decomposed, and this would occur over and over again until the interior temperature was too low for it. Should the action become rhythmic we may begin to understand sun spot periods or stellar variability.

These ideas are not scientific in the limited sense; they are the result of imagination allowed free scope in dealing with imperfect data. The whole fabric must stand or give way according to fitness in the light of advancing knowledge of real facts. The history of science and invention shows that progress often depends upon a fortunate leap in the dark, and that no harm can come from consideration of many suggested hypotheses in a field where so little is known. To forewarn is to forearm even if the final result is to expose a fallacy.

If the writer succeeds in drawing attention more than ever to such a fruitful field of research as the Crookes phenomena furnish he will be satisfied. The conviction can not be escaped that we have in them the opening of a new era in physical science, an extension of limits, a new chemistry, perhaps.

The Keely Motor Again.

A small party consisting of General Manager W. J. Fransioli, of the Manhattan Elevated Railway, Mechanical Engineer Pierson and Mr. Starritt, of the Metropolitan Street Railway Company; Electrical Engineer A. S. Brown, of the Western Union Telegraph Company, and Mr. F. G. Green, all of New York, together with several Philadelphians, were given an oppportunity of viewing the celebrated Keely motor at the Keely laboratory in Philadelphia on Friday, June 18. The machine, which is described as being about the size of a silk hat, was placed upon a glass plate and set in motion, developing what was variously estimated to be from 1-100 to 1-150 horse-power. No chance was given the party to inspect the interior of the device, only a superficial examination being allowed.

Mr. Keely stated that this exhibition was intended merely to demonstrate that the motor would actually move, and that he would shortly exhibit a larger one, which would develop greater power. It is claimed that specifications are being prepared, and that an application will soon be made for a patent.

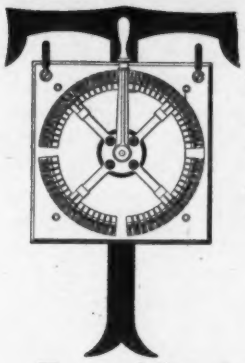
A representative of The Electrical World visited Mr. Brown and Mr. Fransioli in order to obtain their views concerning the motor. Mr. Brown stated that the test was not made under perfectly fair conditions, inasmuch as no permission was given to thoroughly examine the construction. Mr. Fransioli, on the other hand, believed that everything was conducted in a straightforward manner, although it was impossible for him to explain the operation. He absolutely denied the report which was circulated to the effect that the Manhattan Railway contemplated using the principle, if successful, and said that he had joined the party in an entirely unofficial capacity.

Electrical Exhibits at the Royal Society's Soiree.

A London dispatch states that several notable electrical novelties were exhibited at the Royal Society's soiree last week. Lord Kelvin showed conduction through air under the influence of uranium, the work, according to the correspondent, being done "in quasi-perpetual motion manner by contact between uranium and zinc, aluminum or air." Mr. W. H. Preece gave a practical illustration of the system of Marconi of transmitting messages without wires, and Dr. Muirhead exhibited a method of signaling by means of Hertz waves, as practiced by Dr. Oliver Lodge in 1894. An automatic-telegraph transmitter breaking the circuit of the coil and causing short sparks was placed in a distant room. The receiver was in another room, the only source of communication between the two instruments being the waves of impulse sent through the intervening ether. Some new applications of Röntgen rays also excited much curiosity.

Central Station Switchboard Construction.

BY ALBERT B. HERRICK.



THE elements of design that enter into switchboard construction for central stations are those required for the proper internal regulation and control, and external distribution, and further comprehend the employment of such devices as will make the switchboard operation as simple and positive as possible, so that no mistake can be made by the attendant which will hazard the continuous operation of the plant. The cost of attendance and the first cost of the switchboard are both important factors in considering the complete design.

The regulation of the units requires variation of the current strength flowing through the field circuits, in order that they may be thrown into service, and also that the loads may be properly divided between the generators when working in multiple arc, and the proper potential maintained on the consumption circuits. In shunt dynamos the output is varied by a resistance in series with the shunt field, which resistance can be varied to increase or decrease the current flowing through the field circuit. The mechanical device used for varying this field circuit primarily consists of a continuous resistance, from which taps are taken at various points and brought to contact blocks, over which the contact arm traverses, thus increasing or decreasing the resistance in this circuit.

The ordinary form is shown in Fig. 1, which consists of a circle of segments; the current is introduced through the pivot of the lever, and thence to contact buttons, and through the resistance to the other terminal of the regulator. The fault with this device, as usually connected, is that if the lever contact leaves the contact buttons the field circuit is open; if this happens when the machine which is controlled is worked in multiple, serious damage may result; and, again, in large generators many thousand volts may be induced in the field coils on the rupture of the field circuit tending to break down the field insulation. For this reason the permanent connection should be made in all such regulators from the point "A" to "B," so that the field circuit is always continuously through the regulator, even if the lever is detached.

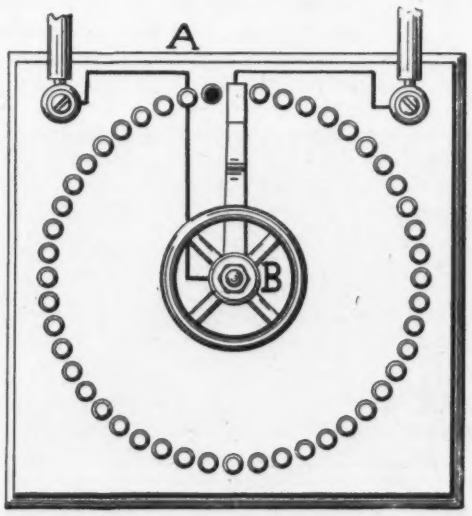


FIG. 1.—REGULATING SWITCH.

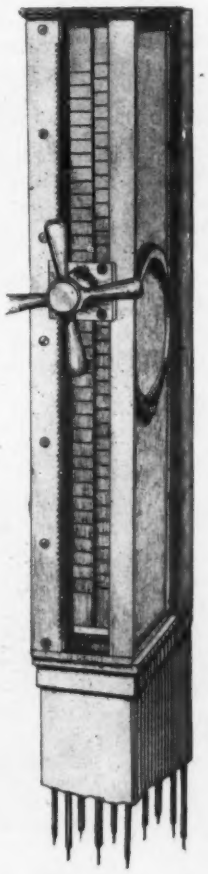


FIG. 2.—REGULATOR WITH PARALLEL CONTACT CLIPS.

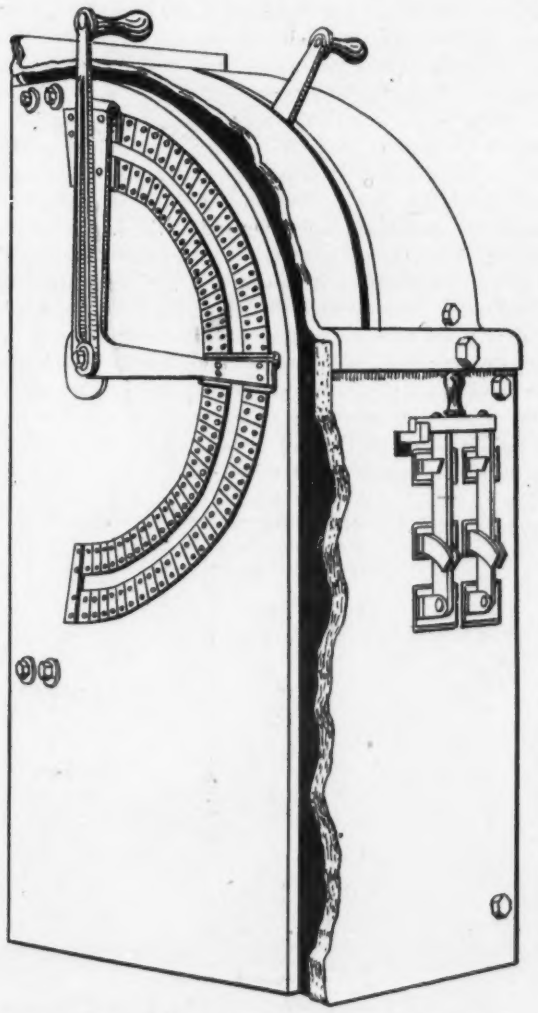


FIG. 3.—STEPS ARRANGED IN PARALLEL QUADRANTS.

In any case where a field circuit of a generator, over 50 kw or larger, is broken, this should always be done slowly and the arc drawn in order that a partial circuit may be maintained through the arc to prevent the discharge of the field from rising to abnormal potential. In general the field switches are provided with field circuit contacts, and on withdrawing the switch it enters another set of contacts which throws a non-inductive resistance across the field terminals, so that when the field circuit is broken the discharged potential is suppressed.

There has been a tendency, in small units especially, to make the dynamo regulator compact. This in itself is a very good feature, but with the same watts lost as the size decreases, the temperature at which the regulator is worked increases, and works the wire nearer its fusing temperature, which practically results in too many breakdowns.

A large factor of safety should be included in dynamo regulators —more than has been allowed in the past. A limiting temperature of ninety degrees centigrade for enamel or grid construction, and fifty degrees centigrade for open spiral coil construction, should not be exceeded. This latter form of construction has been used largely in central station work, simply because the factor of safety has not been sufficient in other types of regulators. The cost of a regulator does not exceed three per cent. of the cost of the generator it controls in units the size used in central station work. To increase the factor of safety of the regulator strengthens the weakest part of the regulating system.

In regard to the total resistance of a regulator, this should be such that the dynamo's potential can be reduced below the normal at no load, when separately excited at normal potential. This is an important point, for a number of manufacturers obtain their rheostat data from tests on their generators which admit of their being self-excited, and with this connection it takes much less resistance to control the generator than when separately excited. In units from 100 kw up the field currents become of considerable magnitude, and the regulators to control the field have to be of special construction in order to properly carry and vary these currents. The contacts and the connections are larger and, generally, switchboards employing units of this size necessitate compactness. Consequently the dial form of regulator is not suitable. Fig. 2 shows a regulator in which the contact clips are arranged in two parallel staggered steps, with a sliding contact bridging them,

which is moved by a pinion in the contact head meshing into a rack on the side of the regulator. This regulator was specially designed for the Chicago Edison Company.

Fig. 3 shows another form designed for the Paterson Edison Company, where the steps are arranged in two parallel quadrants, and so staggered that eighty changes of resistance can be affected by moving the regulator arm through forty degrees. Both of the above regulators are connected to their resistance by what is known as a loop connection, which, in effect, is the same as drawing a con-

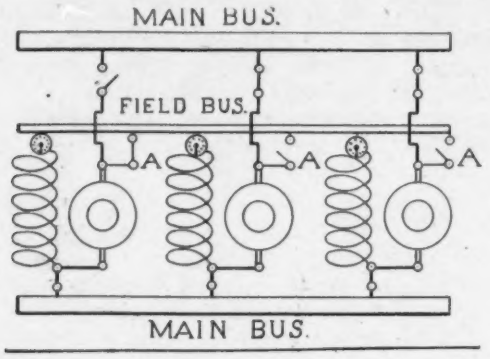


Fig. 4.—Method of Connecting Generators to Field Bus.

tact along two legs of a U-shaped resistance. In both regulators the moving of the contact upward increases the potential or load on the machine. In the quadrant type of regulator it was also necessary to open the field circuit, and to prevent this being opened accidentally, when the machine was in operation, an interlocking device was used which prevented the field switch being withdrawn or thrown in, unless the regulating lever was at its lowest position and the dynamo out of service. Whether the dynamos are to be self-excited or separately excited, or a combination of the two methods, has to be decided in each case, and is dependent upon the special services required of the generators.

The above remarks refer to shunt generators and the shunt winding of compound generators, but the regulation of a compound machine is also affected by its series winding, while the equalizer connections play an important part in dynamo regulation and determine the division of the load between the machines when working in multiple. If all the generators are of the same size and have the same compounding characteristics the resistance, from the equalizing bus to the bus connected to the series side, should be equal for all generators. Where the generators are of different

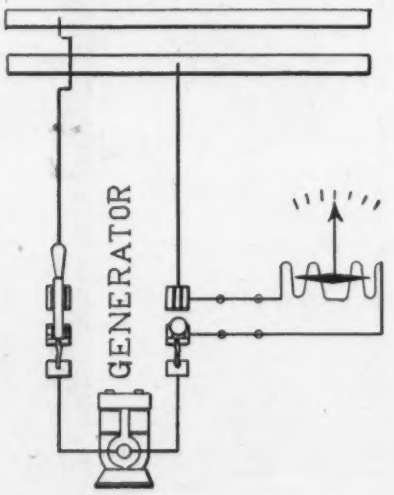


Fig. 5.—Galvanometer Connections.

sizes the drop of potential, when the generators are carrying full load, should be the same for all compound generators working in multiple. Where the dynamos are not of the same type, nor of the same compounding characteristics, the resistance of the equalizer circuit will have to be such that the generators take their maximum load together, but it is hardly possible to compound together dynamos of very different characteristics, so that they will pick up their proportional load equally among themselves. Only the best approximate condition to this result can be obtained when they take their full load together.

Compound generators operating on two or more potentials must be provided with equalizing buses, so that the equalizing leads can be shifted to the equalizing buses to correspond with the potential bus on which a given dynamo is operated, in order that proper regulation may be effected by the series fields. Whether the equalizing is done at the switchboard or at the generator is a question of utility and convenience, as well as of the cost of equalizing conductors, and is a matter which has to be decided in each case. The dynamo lead of the series side of the machine and the equalizer should both be controlled by one double-pole switch, so that the generator can never be put in circuit before it is equalized.

Alternators, and in some cases low-tension dynamos, are excited by a separate generator, and driven by an independent engine. A storage battery has also been proposed for exciting. These methods are required for the purpose of holding the fields up in case of severe overloads, causing the initial potential of the system to fall. In multiple-arc low-tension systems, where there is a bad short circuit of low resistance, it can, by reason of the weakening of the fields due to the combining of excessive armature reaction and reduced potential, throw a station down flat, so that the dynamos have to be withdrawn from the bus and brought up to potential again and all thrown in simultaneously, in order to burn out the short circuit and clear the system. To prevent this accident and not incur the expense of operating a separate exciting system, all generators can be connected to a field bus by means of a single pole-field switch *A*—the connections are shown in Fig. 4—and in this way any generator, not on the main bus, can act temporarily as an exciter for these generators in trouble, by withdrawing their switches to the field bus. This precaution is more important for the large multipolar generators, as they do not have the magnetic stability under the shock of sudden overload of the bipolar type with longer magnetic circuit.

In the control of the units, in order that they may be thrown into service in a multiple-arc system, a means must be provided so that the potential of the generator will be the same as the system it is to be thrown in on. For a small board a voltmeter switch is provided so that a voltmeter can be thrown across the terminals of the dynamo, and its potential adjusted until it is the same as that of the system to which it is to be connected. In large plants it is the practice to provide each generator with a small voltmeter and a pilot switch. This gives flexibility, so that any number of generators can be thrown in or taken off at once. Where there are several different potentials for the dynamos to operate on the pilot switch is a small duplicate of the main dynamo switch, and this having been first connected and the proper voltage attained, indicates the proper time to throw the main switch.

In the older practice dynamo galvanometers were used for these connections (see Fig. 5). Here the switches for the generators should be two single-pole, for one side would have to be thrown in first and the current completed through a high resistance gal-

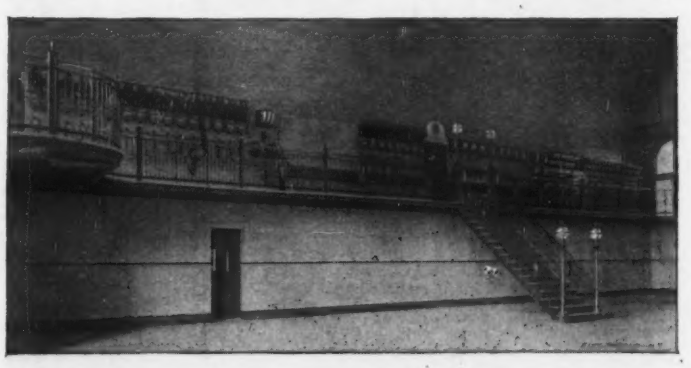


Fig. 6.—Combination Board, Paterson Edison Company.

vanometer. On the other leg around the open switch, when the potential of the generator was equal to the bus potential, the galvanometer showed zero. Another zero method which was used was to have a differential galvanometer, one winding being across the bus and the other across the open dynamo switch. When the potentials on both windings are equal, the hand stands at zero. The evident objection to a zero instrument for this purpose is that it gives the same indications for no current as it does for the correct adjustment of the generator for throwing in. This led to mistakes being made by the switchboard attendants, which resulted in these methods being abandoned.

In throwing alternators in multiple the phase must be in step as well as the potential equal. The visual method is the one which is most commonly used abroad and in this country. It consists of two lamps which are connected in series and complete the circuit of the secondaries of two transformers connected in series, of which the primaries are connected to the alternator on the load, and to the alternator to be thrown in multiple. The lamps will give a pulsating light, dependent upon the phase relation of the two machines. When the machines are in phase or step there will be no light, and the alternators will be ready to be thrown together. Any

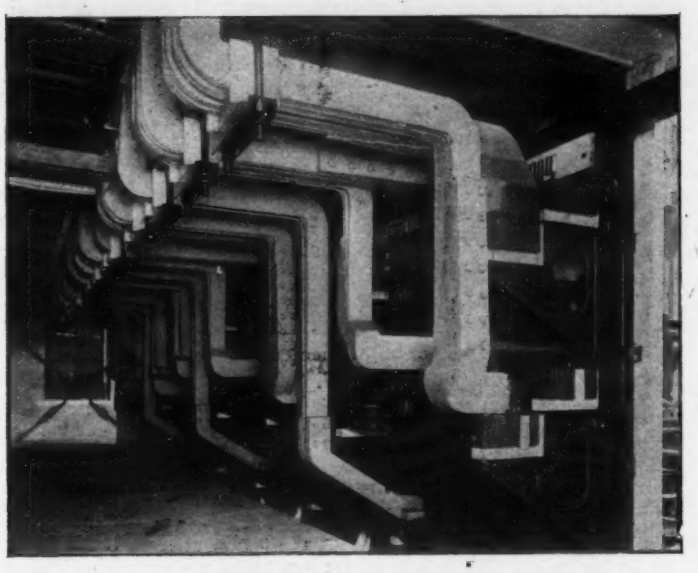


FIG. 7.—COPPER CONNECTIONS BEHIND BOARD.

slight phase differences in throwing them together will be rectified by the alternators themselves. A phonetic method consists of a diaphragm located between two electromagnets, each being actuated by one of the generators to be thrown together. When these generators are in step no sound will be emitted from the synchronizer.

The external distribution in the low-potential multiple-arc systems requires, at different periods of the load, a variation of potential at the station in order that the current may be delivered to the consumption circuits at a constant voltage. In an unsymmetrical system of mains the raising of the station pressure will in some cases be sufficient, if the maximum variation for the system is such that it will not reduce the life of the lamps on the system, but where the external system of distribution is extensive, the nearby circuits will have to be provided with a potential that is lower than the average, and the outlying districts with a potential higher than the average so that the feeding system has to be split up into several sections and fed by currents of potentials different from that of the main bus. There are a number of ways by which this can be accomplished. The old and abandoned method is the equalizer, or inserting resistance in series with the feeders; the next step the one of putting in more copper and cutting out the equalizer; and the next the supplementary busses to which the feeders could be attached and supplied by different potentials. It has also been the practice to detach feeders from the system in order to increase the drop in districts located near the station, or where there is small current consumed, and in this way allow of a greater variation of potential on the bus, without affecting the nearby supply systems. The method of creating potentials for the auxiliary busses have been separate dynamos, boosters, storage batteries and resistance devices between the busses.

The provision for maintaining uniform potential on the consumption circuits only exists during the "peak" or the heavy load on the distribution system. During low loads and night loads, all the feeders generally come down to a common bus, and the best method to adopt will obviously be influenced by the conditions to be met.

In alternating-current practice in America, the alternators are generally run on independent groups of feeders, and this requires that each feeder be so arranged that it can be thrown on any alternator, so that, from the feeder loads, a full load on the alternator can be obtained. A combination of plugs and double-throw switches is usually employed for this purpose, in which the feeders can be plugged up to any dynamo.

In monocyclic systems the switchboard is treated very much as if it were a three-wire system, the teaser or power circuit connections being the third wire.

There is another case where a difference of potential of bus is necesary in railway work in order to reduce electrolysis, and in order to confine the "sneak currents" entirely to the pipe system. The pipe system ground return is kept at a lower negative potential than the track return.

In alternating-current distribution the feeder potential at the station end can be varied from the main potential by reactive or transforming devices, by means of which their potential can be raised or lowered from that given by the operating generator.

The switchboard construction comprehends the assembling of the apparatus most suitable for the purpose, but there are two general methods used in switchboard construction. One is that in which the regulating apparatus for all units is brought together on one part of the switchboard, and the dynamo and feeder-boards consist of the switches and ammeters only. The other and almost universal method is one in which the dynamo panel contains the regulating apparatus, the field switches, dynamo switches, dynamo ammeters and a complete equipment for one or a pair of units. The pressure is read on the voltmeters, and the main wattmeters are located on the pressure board, as well as the feeder pressure switch. This brings the feeders together on a separate board with their ammeters and switches.

The illustrations of switchboard practice have been selected from the author's designs. Fig. 8 shows the Chicago Edison Company's switchboard, having a capacity of 180,000 amperes, Edison three-wire system of three potentials. The switchboard is built in two tiers, the dynamos below and the feeders above, all located on the gallery above the engine-room floor. Fig. 7 shows the copper connections behind the board from the dynamo to the feeder board. Fig. 6 shows a combination board, designed for the Paterson Edison Company, which includes a 2500 arc light, 10,000 ampere, two potential, three-wire incandescent board and a 6000 ampere, two potential railway board. The gallery is of cantilever construction and ninety-two feet long.

The framework of switchboards is constructed of channel or

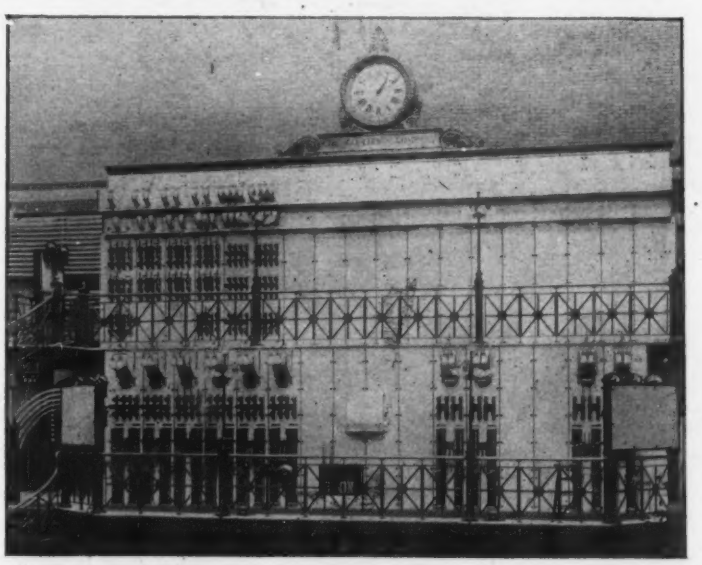


FIG. 8.—SWITCHBOARD, CHICAGO EDISON STATION.

angle iron verticals, with "Z" bar or channel horizontals. The surface on which the apparatus is mounted is slate or marble. In either case the material should be tested, as serious leaks may occur on the board, due to veins of iron haematite through the stone.

According to their ease of work, the slate stands first, then Vermont marble, Italian marble, Tennessee marble and gray granite. According to their insulating qualities, they would be arranged: Tennessee marble, Italian marble, granite, slate and Vermont marble. The last is hardly applicable to switchboard construction,

as it is too friable and readily absorbs moisture. Marble can be readily procured, if drawings are furnished for each piece, down to one-sixty-fourth of an inch; this allows all panels on the switchboards to be interchangeable, which is a great advantage. Also in case there is any graining on the marble, the graining can be matched up from one panel to another if so ordered.

In voltages for 1000 and over the board, whether marble or slate, should not be depended upon to insulate the metallic connections required. Bushings of rubber or micanite should be interposed between the metallic connections and the board itself. Do not use fibre here. Slate has been seen to explode under the leakages caused by difference of potential of 1200 volts.

The iron frame-work should be insulated from the iron structural part of the station, and different sections of a composite board should also be insulated from each other. The most economical way in which to obtain proper switchboard construction for the station is to have it first completely designed, and from the designs to order all the apparatus and material under competitive bids, as a drill press is the only machinery required to assemble a switchboard, and local mechanics with a little instruction are all that is necessary to make an excellent piece of work, and save a large amount of money by not having the switchboard construction done away from the station, in which case the board would have to be practically reassembled twice and a great many misfits and breakages added to the expense. In this way the central station manager can get a switchboard which is designed to meet the special conditions which arise in his plant at the least first cost.

A New Armature Winding Diagram.

BY FRANCIS H. DOANE.

The study of the winding and connections of armatures is usually greatly facilitated by reference to the various styles of winding diagrams.

The form of diagram here illustrated was devised while working on an armature problem by the aid of the mode of representation originally suggested by Herr Fritsche, of Berlin. The improvement consisted of bending into circles his flat development of an armature, thus doing away with the unconnected wires at either end, but allowing all the wires and connections to be easily traced.

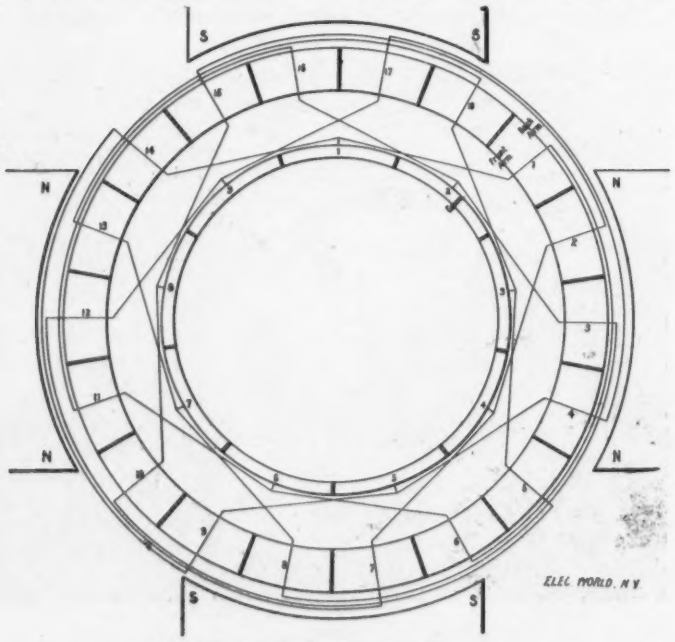


Diagram of Armature Winding.

The inner ring represents the commutator, the large outer ring the armature, showing both the front and the back.

A typical four-pole wave winding was selected as an illustration. Starting to trace the winding from commutator section No. 1, the wire passes through the body of the armature four times and ends in commutator section No. 2; starting from section No. 2, the end of the wire goes to section No. 3. The last wire traced comes into commutator section No. 1, thus completing the closed circuit of the armature. The wires cross each other in such a manner as not to interfere with the tracing of connections.

Marconi System of Wireless Telegraphy.

In view of the widespread attention that is being directed to the Marconi system of signaling through space without the medium of wires, and the active support given to it by Mr. W. H. Preece, of the British Post Office, it will be of interest to our readers to give some of the details of the methods and apparatus employed. On June 4 last Mr. Preece gave a description of the Marconi system before the Royal Institution, and from his discourse as reported in the London *Electrician* we make the following abstract:

Mr. Marconi utilizes electric or Hertzian waves of very high frequency. He has invented a new relay which, for sensitiveness and delicacy, exceeds all known electrical apparatus.

The peculiarity of Mr. Marconi's system is that, apart from the ordinary connecting wires of the apparatus, conductors of very moderate length only are needed, and even these can be dispensed with if reflectors are used. His transmitter is Professor Righi's form of Hertz's radiator. (Fig. 1.)

Two spheres of solid brass, 4 inches in diameter (A and B), are fixed in an oil-tight case, D, of insulating material, so that a hemisphere of each is exposed, the other hemisphere being immersed in a bath of vaseline oil. Mr. Marconi uses, generally, waves of about 120 centimeters long. Two small spheres, a and b, are fixed close to the large spheres and connected each to one end of the secondary circuit of the induction coil, C, the primary circuit of which is excited by a battery, E, thrown in and out of circuit by the Morse key, K. Now, whenever the key, K, is deprssed sparks pass between 1, 2 and 3, and since the system A B contains capacity and electric inertia, oscillations are set up in it of extreme rapidity. The line of propagation is D d, and the frequency of oscillation is probably about 250,000,000 per second.

The distance at which effects are produced with such rapid oscillations depends chiefly on the energy in the discharge that passes. A 6-inch spark coil has sufficed through 1, 2, 3 up to 4 miles, but for greater distances we have used a more powerful coil—one emitting sparks 20 inches long. It may also be pointed out that this distance increases with the diameter of the spheres A and B, and it is nearly doubled by making the spheres solid instead of hollow.

Marconi's relay (Fig. 1) consists of a small glass tube four centimeters long, into which two silver pole-pieces are tightly fitted,

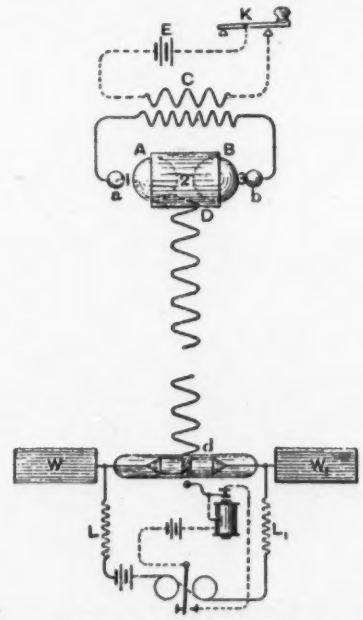


Fig. 1.—Diagram of Marconi Apparatus.

separated from each other by about half a millimeter—a thin space which is filled up by a mixture of fine nickel and silver filings, mixed with a trace of mercury. The tube is exhausted to a vacuum of 4 mm., and sealed. It forms part of a circuit containing a local cell and a sensitive telegraph relay. In its normal condition the metallic powder is virtually an insulator. The particles lie higgledy-piggledy, anyhow in disorder. They lightly touch each other in an irregular method, but when electric waves fall upon them they are "polarized"—order is installed. They are marshaled in serried ranks; they are subject to pressure—in fact, as Prof.

Oliver Lodge expresses it, they "cohere"—electrical contact ensues, and a current passes. The resistance of such a space falls from infinity to about five ohms. The electric resistance of Marconi's relay—that is, the resistance of the thin disc of loose powder—is practically infinite when it is in its normal or disordered condition. It is then, in fact, an insulator. This resistance drops sometimes to five ohms, when the absorption of the electric waves by it is intense. It therefore becomes a conductor. It may be, as suggested by Professor Lodge, that we have in the measurement of the variable resistance of this instrument a means of determining the intensity of the energy falling upon it. This variation is being investigated both as regards the magnitude of the energy and the frequency of the incident waves. Mons. E. Branly (1890) showed this effect with copper, aluminum and iron filings. Prof. Oliver Lodge, who has done more than any one else in England to illustrate and popularize the work of Hertz and his followers, has given the name "coherer" to this form of apparatus. Marconi "decoheres" by making the local current very rapidly vibrate a small hammer head against the glass tube, which it does effectually, and in doing so makes such a sound that reading Morse characters is easy. The same current that decoheres can also record Morse signals on paper, by ink. The exhausted tube has two wings

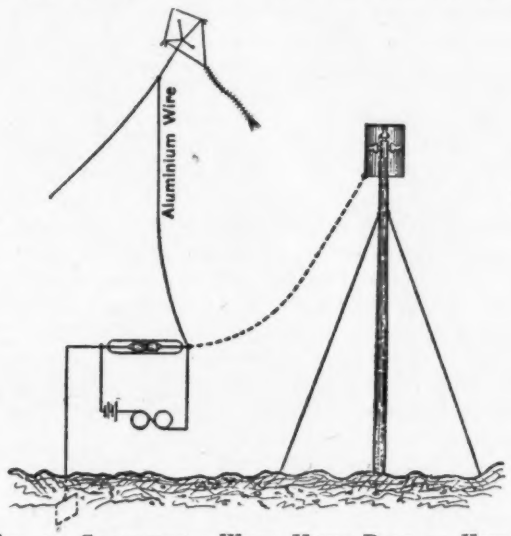


FIG. 2.—CONNECTIONS WHEN USING POLE OR KITE.

which, by their size, tune the receiver to the transmitter by varying the capacity of the apparatus.* Choking coils prevent the energy escaping. The analogy to Prof. Silvanus Thompson's wave apparatus is evident. Oscillations set up in the transmitter fall upon the receiver tuned in sympathy with it, coherence follows, currents are excited, and signals made.

In open clear spaces within sight of each other nothing more is wanted, but when obstacles intervene and great distances are in question height is needed—tall masts, kites and balloons have been used. Excellent signals have been transmitted between Penarth and Brean Down, near Weston-super-Mare, across the Bristol Channel, a distance of nearly nine miles.

Mirrors also assist and intensify the effects. They were used in the earlier experiments, but they have been laid aside for the present, for they are not only expensive to make, but they occupy much time in manufacture.

The wings shown in Fig. 1 may be removed. One pole can be connected with earth, and the other extended up to the top of the mast, or fastened to a balloon by means of a wire. The wire and balloon or kite covered with tin foil becomes the wing. In this case one pole of the transmitter must also be connected with earth. This is shown by Fig. 2.

There are some apparent anomalies that have developed themselves during the experiments. Mr. Marconi finds that his relay acts even when it is placed in a perfectly closed metallic box. This is the fact that has given rise to the rumor that he can blow up an ironclad ship. This might be true if he could plant his properly tuned receiver in the magazine of an enemy's ship.

The distance to which signals have been sent is remarkable. On Salisbury Plain Mr. Marconi covered a distance of four miles. In the Bristol Channel this has been extended to over eight miles, and we have by no means reached the limit. It is interesting to read the surmises of others. Half a mile was the wildest dream.†

It is easy to transmit many messages in any direction at the same time. It is only necessary to tune the transmitters and receivers to the same frequency or "note." I could show this here, but we are bothered by reflection from the walls. This does not happen in open space. Tuning is very easy. It is simply necessary to vary the capacity of the receiver, and this is done by increasing the length of the wings, W, in Fig. 1. The proper length is found experimentally close to the transmitter. It is practically impossible to do so far away.

It has been said that Mr. Marconi has done nothing new. He has not discovered any new rays; his transmitter is comparatively old; his receiver is based on Branly's coherer. Columbus did not invent the egg, but he showed how to make it stand on its end, and Marconi has produced from known means a new electric eye more delicate than any known electric instrument, and a new system of telegraphy that will reach places hitherto inaccessible. There are a great many practical points connected with this system that require to be threshed out in a practical manner before it can be placed on the market, but enough has been done to prove its value and to show that for shipping and lighthouse purposes, it will be a great and valuable acquisition.

The Application of Electricity to Steam Railroads.

At the recent convention of the Master Mechanics' Association, at Old Point Comfort, Va., Mr. Paul H. Brangs, electrician and gas engineer of the Delaware, Lackawanna & Western Railroad, read a paper on the above-named subject.

The recent developments in the application of electricity to the present existing steam railroads, he said, is a question that is of great interest to the practical railroad men of the present day, and the many advantages to be gained by the partial substitution of electricity for steam in conjunction with the steam locomotive, must be apparent to all wideawake railroad managers. The tremendous inroads that have been made in the receipts of local passenger traffic, on the majority of steam railroads of to-day, by the electric trolley roads, makes it manifest that something must be done to check these inroads. The trolley lines have paralleled our railroads in many cases to such an extent that it has put the railroad managers to severe perplexity as to the best method of meeting this great competitor. Many railroads running from large cities into the suburbs, which have large suburban traffic, are at a loss to know how they can accommodate the demands of the public for more frequent trains, without very materially increasing their operating expenses. This, of course, is a very grave matter, as short and frequent trains, with locomotive traction, are expensive, in view of the fact that each train must be fully equipped with locomotive, engineer and fireman, and a full crew, whether there be three cars or ten.

The running of short and frequent trains by locomotive traction would not be so extravagant if the motive-power department had at all times such sizes and weights of locomotives as was best suited for the purposes required. The tendency of late years, however, has been toward heavier and more powerful locomotives, so that when called upon they can haul the heaviest and largest trains; but it is only during certain hours of the morning and evening when traffic is heavy that they are required to haul such heavy trains, consequently, at other hours, one can see these same powerful and heavy locomotives hauling trains of one-quarter or one-third their actual capacity.

By the partial substitution of electrical traction for the exclusive locomotive traction, the heavy locomotives could be still used for drawing heavy through express and freight trains, while the short and local trains could be run by electricity.

Most of the railroads running into large cities, which have a large commutation or suburban traffic, have four tracks running for some distance from such cities. In that event I would advocate

*The period of vibration of a circuit is given by the equation $T = 2\pi\sqrt{KL}$ so that we have simply to vary either the capacity K or the so-called "self-induction" L to tune the receiver to any frequency. It is simpler to vary K.

†"Unfortunately at present we cannot detect the electromagnetic waves more than 100 feet from their source."—Trowbridge, 1897, "What is Electricity," page 256.

"I mention 40 yards because that was one of the first out-of-door experiments, but I should think that something more like half a mile was nearer the limit of sensibility. However, this is a rash statement not at present verified."—Oliver Lodge, 1894, "The Work of Hertz," page 18.

equipping two tracks with electricity, and running two or three car trains at short intervals, thereby making it a rapid-transit system.

Almost every one of the trunk lines running into New York City have a more or less number of leased lines and branches, which are used as feeders for the trunk lines. These lines are also particularly favorable as regards grades and locations for the trolley lines. There are certain kinds of local traffic which the steam railroads must, to a large extent, lose, and which, in the nature of things, they cannot regain. In large cities having considerable suburban traffic, the trolley roads, forming as they do a network of lines in the city and extending in every direction into the suburbs, offer advantages with which the steam railroad cannot compete. As far as these branch lines go, whether it would pay to partially or wholly substitute electricity for steam depends upon the local conditions prevailing.

I would advocate, as far as possible, the equipping of these small branches electrically, and as the gauge of road bed and other things would be the same, this would greatly facilitate the matter while change of construction was going on. I fully believe that if many of the small branches of the various railroads centered around New York City were equipped electrically, so that short and frequent trains could be run at a profit, it would add very materially to the advantages of the trunk line.

Objection will be made that the trolley, or the third rail, as the case may be, would interfere with the operation of the steam railroad, but I see no reason why they could not be run jointly. During such hours of the day when traffic might be light, freight might be drawn by electric motors to the various small towns along the line. This in itself would be a very great saving, as now special freight trains have to be made up. The consumer is now often put to great inconvenience by only getting one freight train a day, whereas, by the partial substitution of electricity, these cars could be drawn by the same electric motor cars used for the passenger traffic. Another important adjunct to this would be the quick delivery of express matter, which is, of course, a source of great revenue to the railroad companies.

As to the use of either the third rail or the trolley, there has not been sufficient experience with the third rail on the New York, New Haven & Hartford road to fully demonstrate whether the change from the trolley to the third rail would be advisable. I certainly do not approve of the unprotected third rail, when it is open to all kinds of accidents and malicious interference. This could be easily be avoided by the substitution of a rail at the side of the track, with a side contact, and with the exposed parts covered over and insulated in such a way that any object falling from above, or persons stepping across, would not be so liable to come in contact with the exposed live rail.

There are many advantages, however, in the construction of a third rail over the trolley system, and it has been demonstrated by the conclusions arrived at by Col. N. H. Heft, electrician of the New York, New Haven & Hartford Railroad Company, that the cost of the third rail is about one-half that of the trolley system. It would therefore appear that it would commend itself to all practical railroad men as the best method of supplying the current.

The great interest that has been taken of late in electric traction, said Mr. Brangs, in conclusion, and the discussions on the subject by various railroad clubs, and particularly that on rapid transit, by the New York Railroad Club, must make it apparent to all that this subject is and will be one of the great questions to tax the efforts of steam, as well as electrical, engineers.

I do not wish to be understood as saying that the locomotive has not a very long lease of life, and is not a very useful and efficient machine when properly handled; the recent productions in simple as well as compound locomotives are wonderful achievements of mechanical skill, but it must be conceded by all well-informed steam locomotive, as well as electrical, engineers, that the locomotive will be superseded by the electric locomotive in special cases.

An Aid to the Memory.

Mr. Preece in a recent lecture stated that the velocity of light and electric waves, namely, 186,400 miles per second, may be easily remembered from the fact that it was in the year 1864 that Maxwell made his famous discovery of the identity of light and electric waves. Whether it is easier to remember the first or the second of these figures is a question, but at all events the curious coincidence of the two numbers is of interest.

Convention of Railway Telegraph Superintendents.

The sixteenth annual meeting of the Association of Railway Telegraph Superintendents was held at the Cataract House, Niagara Falls, on June 16 and 17. In the absence of President George M. Dugan, Vice-President John W. Lattig occupied the chair. The first session began at 10:15 A. M, June 16, but owing to the arrival of but few members up to that time adjournment was taken until 7:30 P. M. At the evening session Mr. Charles Selden read a paper entitled "Railroad Telegrams." He referred to a system of checking introduced on his road (the Baltimore & Ohio), which had effectually reduced to a minimum errors in quotations of prices. Another innovation introduced on these lines was a system of charging railroad-service telegrams to the departments from which they originate. The object of this was to show the actual cost of the telegraph service of each department, and at the same time reduce the volume of the business on the wires to a more reasonable limit. The charges for telegrams are 10 cents for ten words, and 20 cents for messages over ten words. At the end of every month each department is rendered a bill covering the cost of service messages. The effect of this up to the present time has been to greatly rid the telegraph wires of business which properly belongs to the mail, and facilitate the transaction of legitimate business. The telegraph department is charged by every other department of a railroad for any service rendered it, and why should not the telegraph department do likewise? The system had worked very satisfactorily on the Baltimore & Ohio road and had received the earnest support of the general manager of the company. After a short discussion Mr. Asa R. Swift read a paper entitled "The Telegraph," and this was followed by one by Mr. George C. Kinsman on "The Apprenticeship System."

Secretary P. W. Drew then read a paper, written by Mr. L. H. Korty, of the Union Pacific road, entitled "The Delivery of Commercial Telegrams at Railroad Offices." Mr. Korty emphasized the importance of securing receipts for telegrams delivered to conductors for delivery to persons on trains. This was a precaution very largely neglected, and the result was loss of all trace of such telegrams after leaving the hands of the receiving operator. On the Union Pacific road all conductors are required to give receipts for telegrams thus received, and report at the first opportunity any failure to find the person addressed. This system had been in operation for two and one-half years, and in that time there had not been a single failure of a commercial message reaching a passenger on the Union Pacific system.

Thursday's session was called to order at 9:30 A. M. The secretary read several letters of regret from members and others who had not been able to be present, including one from Mr. Thomas A. Edison. Mr. Edison, it is stated, had fully intended to attend this meeting, but at the last moment certain business affairs had taken such a turn as to prevent him from leaving. Letters were also read from the Mayor of Nashville, Tenn., the Governor of Tennessee, and the Director-General of the Tennessee Centennial & International Exposition, inviting the members of the association, individually, or in a body, to attend the exposition now being held in Nashville. A cordial and hearty welcome was extended.

The Committee on Low-Resistance Relay Experiments, which was appointed at the last meeting, made its report. During the year it had conducted various experiments in the use of low-resistance relays in place of the standard instruments, and found that they gave, without any exception, the most beneficial results in the operation of railroad telegraph lines in all kinds of weather. Wires which hitherto had to be divided into two or more parts in very stormy weather, and each part worked separately, now worked through in a most satisfactory manner, by the use of 25-ohm relays, in place of the 150-ohm instruments. The result of the committee's investigations was apparently contradictory of the generally accepted law that the resistance of the instruments in a telegraph circuit shall equal the resistance of the wire, plus that of the batteries. The committee, however, states as its opinion, that the trouble with the old theory lies in its application to telegraph circuits. The theory aimed to secure the maximum magnetic effect in an electromagnet, and does not take into consideration the effect of leakage, retardation or self-induction of the relays on a telegraph circuit.

The election of officers for the ensuing year resulted as follows: President, J. W. Lattig, of the Lehigh Valley road; vice-president, W. W. Ryder, of the Chicago, Burlington & Quincy; secretary and treasurer, P. W. Drew, of the Wisconsin Central. Mr.

Ryder invited the association, in the name of the general manager of the Chicago, Burlington & Quincy road, to hold its next meeting at Hot Springs, S. Dak. The invitation was accepted, and the date of the meeting set as the third Wednesday in June, 1898.

Mr. Thomas D. Lockwood then read a paper entitled "The Relay and Its Relation to the Telegraphic Circuit." This paper, although rather lengthy, was listened to with deep interest by the members.

Mr. Lockwood discussed the principles of relay construction and gave a brief historical account of the development of the electromagnet. The application of the electromagnet to telegraph circuits was considered briefly, and Mr. Lockwood stated the reasons why long lengths of fine wire were wound around the magnet cores. The essential thing, he said, was to obtain ampere turns. The advantages of using low-resistance relays on telegraph circuits where several instruments were connected to the line were thoroughly discussed. The Committee on Relay Experiments was continued and requested to conduct their tests and report results at the next meeting. The convention then at 1 o'clock adjourned.

A few exhibits were shown in an adjoining room:

THE PARRISH SIGNAL COMPANY, Jackson, Mich., showed a sample of its crossing signal.

MESSRS. J. H. BUNNELL & CO., New York, made an exhibit of a large electric gong and several telegraph instruments and switches.

MR. A. P. ECKERT represented the interests of the Safety Insulated Wire & Cable Company, New York, and strongly advocated the use of Safety wire in the railroad-telegraph service.

THE S. & R. AUTOMATIC CROSSING SIGNAL was exhibited by Mr. Charles Selden, of Baltimore. In this signal, which is electric, the bell rings until the entire train passes the crossing on either a single or double track.

MR. W. S. ECKERT was present at the meeting in the interests of the Bi-Metallic Electric Transmission Company, New York. He carried an exhibit with him in his pocket in the shape of samples of bi-metallic wire.

THE NATIONAL SELF-WINDING CLOCK COMPANY, Elgin, Ill., showed the mechanism of two self-winding and self-synchronizing clocks. These clocks have been greatly simplified within the past year, and are said to be perfectly reliable.

MESSRS. J. D. TAYLOR & CO., Chillicothe, Ohio, had on exhibition a sample of their highway-crossing signal for single or double tracks. Among the advantages of this instrument may be mentioned—few parts, few electric contacts and consequent simplicity in construction and reliability in action. The signal-circuit closer is controlled by a simple mechanical interlocking device.

The members of the association on the afternoon of June 16 visited the power house of the Niagara Falls Power Company, and were greatly interested in the operation of the large generators and other apparatus. Through the courtesy of resident engineer W. A. Brackenridge and Superintendent Lincoln, the party was shown all through the plant, and the extension of the great wheel pit was the subject of great interest to the visitors, as were also the various other features in and about the station. On Thursday afternoon rides were taken on the Gorge Railway on the American side, and on the Niagara Falls Park & River Railroad on the Canadian side. Several of the members were accompanied by their wives and daughters, and altogether a very enjoyable and profitable time was had during the stay.

The Enclosed Arc Lamp.

To the Editor of The Electrical World:

SIR—In the paper on "Recent Progress in Arc Lighting," read on June 9, by Professor Elihu Thomson, at the Niagara Falls convention of the National Electric Light Association, and published in your issue of June 12, much space is naturally devoted to the discussion of the enclosed arc lamp. Professor Thomson remarks "the enclosed arc lamp, broadly speaking, is an outcome of the ability to secure very nearly pure carbons." He also claims to have made some experiments in this field in 1879 and states that "for many years after that date (1879) there were not to be found such pure carbons as would give so little deposition as is required to work an enclosed arc practically."

I am much surprised that one so well posted in the state of the art as Professor Thomson, should ascribe the success of the enclosed arc to the "ability to secure very nearly pure carbons." As pointed out in my recent paper read before the International Electrical Society at Paris, in January of this year, the history of the development of the enclosed arc is the record of a succession of failures up to 1894, when, as a result of my work the first successful enclosed arc lamps were put on the market. The commercial enclosed arc lamp is only three years old. Of the thirty-odd thousand enclosed arcs now in successful daily operation in this country, nine-tenths have been installed within the past two years. Was this phenomenal growth due to the discovery of a pure carbon? Inasmuch as practically the same grade of enclosed arc carbon as is now extensively used was to be found in the open market at least five years before the advent of the successful enclosed arc lamp, the sudden rise must have been due to another cause.

As Professor Thomson has remarked, and as pointed out by me in my Paris paper, "the idea of burning an arc in a practically closed and relatively small glass chamber is quite old," but the idea of operating a high potential arc within an enclosure and maintaining the arc with a small expenditure of current is, however, new. Although years before I had used very nearly pure carbons in my investigations with enclosed arcs, still the experiments resulted in failure after failure, until the idea of the high potential arc was evolved by me. This method of operation, an account of which was first given to the National Electric Light Association at the Washington, D. C., convention, in February, 1894, involves an essential principle of all practical enclosed arcs, and marked the beginning of the commercial enclosed arc lamp industry.

As a contribution to the history of the art, Professor Thomson's reference to his unsuccessful experiments in this line is interesting, as is all that comes from his pen; but it is quite clear that the successful introduction of the enclosed arc system was not due to his efforts.

L. B. MARKS.

Reported Consolidation of the Siemens & Halske Company and the Pennsylvania Iron Works Company.

It is announced in a New York paper that the Siemens & Halske Electric Company, Chicago, has been absorbed by the Pennsylvania Iron Works Company, Philadelphia, Pa. The consolidation was consummated at the annual meeting of the former company in Chicago, at which additional representation in the board was given to the Philadelphia interests by the election as directors of Charles E. Yerkes, William L. Elkins, Jr., and B. W. Grist. The other directors are Charles T. Yerkes, R. Suydam Grant, F. W. Whitridge, W. T. Butler, E. Z. Rice and Martin Maloney.

Mr. Charles T. Yerkes and some of his friends, it is stated, bought a large interest in the Siemens & Halske Company about a year ago, and have now brought about the consolidation with the Pennsylvania Iron Works Company, which is owned by what is known as the Philadelphia Street Car Syndicate.

The Pennsylvania Iron Works Company absorbs the Siemens & Halske Company by an exchange of its stock for that of the latter company. It is not thought that the name of the Chicago company will be changed, and each concern will continue to manufacture as before.

The Pennsylvania Iron Works Company manufactures cable railway machinery, winding and driving machinery, and gas and steam engines, so that the two companies can now completely equip street railways with either cable or electric machinery. The capital stock of this company is $3,250,000, of which $1,000,000 of preferred and $1,000,000 of common stock is issued in exchange for the $700,000 of preferred and $1,300,000 of common stock of the Siemens & Halske Company.

Patent Office Rules Revived.

A dispatch from Washington states that the rules of practice of the Patent Office as formulated by Commissioner Seymour, have been revoked, and the old rules, dated April 1, 1892, with certain amendments, have been re-enacted. These amendments include the omission of rules 181 to 194, inclusive, which relate to extensions. Other amendments of less importance are also made. It is stated that the abrogation of the rules formulated by Commissioner Seymour has been strongly urged by patent attorneys, and after a careful examination of the whole matter, Commissioner Butterworth has decided to revise the rules of 1892, with certain amendments, which his long experience in the office has demonstrated to be necessary.

Detroit Convention of the National Independent Telephone Association of the United States of America.

The first convention of the Independent Telephone Association of the United States of America has passed into history. To those who will look back upon it from future years it will mark the beginning of what cannot fail to be one of the most important industrial movements of recent years. The large attendance and enthusiastic spirit which marked the meeting in Detroit are omens of future success, while, considering the short notice given, the chaotic condition of independent telephony at this time and the great distances which many delegates were obliged to travel, they were truly remarkable.

There was no noticeable discord. While nearly every proposition laid before the convention was vigorously debated and thoroughly ventilated, the discussions were not bitter, and the final subscription of so many exchanges to the roll of the association was an indication of an almost unanimous intention to make it an instrument of advancement to the interests of independent telephony.

Perhaps the most noticeable feature of the gathering was its business-like earnestness. The men who composed the convention represented a class of pioneers—men of affairs, with the courage to take an advanced stand—and their meeting was marked with a deliberate earnestness of purpose which seems an index to future success in their undertakings.

Report of the Convention.

FIRST DAY—TUESDAY, JUNE 22.

The convention was called to order at 2:30 P. M. in Harmonie Hall, a large and handsome building well fitted for the uses of such a meeting, by Hon. Charles Flowers, of Detroit. With a few appropriate remarks, Mr. Flowers introduced the Hon. H. C. Maybury, Mayor of Detroit, who made a brief and humorous address of welcome to the delegates. He said that the telephone was the fairy story of to-day. Men had grown larger and the world had grown smaller through its appearance. Everybody is interested in the establishment of good and prompt telephone service, and of fair dealing between the exchanges and the public. In bidding the convention welcome to Detroit Mayor Maybury said that the police had been instructed that the watchword of the day was "Hello," and that any delegate who needed anything had only to approach a guardian of the peace with this mystic word, when he would immediately reply: "What number?" The delegate would thus establish friendly relations and be connected promptly with what he desired.

Following the Mayor's address, Hon. Charles Flowers bade the convention welcome on behalf of the Detroit Telephone Company. He said that the general law of nature was evolution, which resulted in the general good. The processes of this are oftentimes slow, requiring the persistent efforts of trained minds for their control and government. When an occasion arises requiring special effort the men to make it are always found. He said that at this meeting the delegates had gathered to show themselves and establish a great national organization. A spirit of business common sense had been ushered in, and speculative profits could no longer be made by the great corporations. These must now content themselves with ordinary profits. The man who speaks should no longer have a tribute levied upon him, not for the enrichment of an inventor, but for the continuance of a monopoly. The right to plunder by forms of law had expired by limitation, and these delegates had met to establish commercial relations on the broad basis of public policy.

In conclusion, Mr. Flowers welcomed the delegates to Detroit in the name of his company. He said he was proud of being connected with the largest independent telephone exchange in the world, which was established in the face of much opposition. He cordially invited the delegates to inspect it.

The address was received with much applause on the part of the convention. At the conclusion of Mr. Flowers' remarks, Judge James M. Thomas, of Chillicothe, Ohio, president *pro tem.* of the association, made a brief address. After finishing his remarks President Thomas called upon Judge R. S. Taylor, of Fort Wayne, Ind., to address the convention. Judge Taylor, who is widely known as the leading counsel for the Government in the recent Berliner case, made a strong and forceful presentation of the objects of the convention, of which the full text appears in another column. His remarks were frequently punctuated with applause.

At the conclusion of Judge Taylor's remarks President Thomas made his opening address, which will be found in another column.

After announcing that the temporary Executive Committee, appointed at Chicago, would not be ready to report for some hours, the president, upon motion, appointed a Committee on Credentials to examine the status of those present. A motion that those presenting credentials be required to subscribe themselves members of the association upon their admission by the committee, was ruled out on a point of order.

The Committee on Credentials reported that satisfactory papers had been presented by representatives of ninety-nine exchanges and twenty-one manufacturing organizations.

At this point a warm discussion ensued, concerning proper representation of exchanges present only by proxy. Some gentlemen from Pennsylvania and Tennessee had brought large numbers of proxies with them, and insisted upon voting them. After a discussion lasting nearly an hour the report of the Committee on Credentials was accepted without amendment, the question of the admission of proxies being laid over until it could be more properly discussed in connection with the report of the Executive Committee. An adjournment was then taken until evening.

At 8 P. M. the convention again assembled, President Thomas in the chair, and heard the report of the temporary Executive Committee, read by Secretary H. D. Critchfield, of Newark, Ohio. This report consisted of a draft of a proposed constitution, which had been prepared by the committee after an almost continuous session of thirty-six hours. The constitution, as finally amended and adopted, is published elsewhere in this issue.

After the reading of the draft, Mr. A. B. Coon, of Marengo, Ill., proposed a recess for the consideration of the credentials of those not present at the afternoon session. This was taken, and representatives of seventeen exchanges and two manufacturers given the privileges of the floor.

The constitution was then taken up article by article for adoption. Shortly after the beginning of the discussion, upon motion by Mr. I. A. Lumpkin, of Mattoon, Ill., it was agreed to clear the hall, appoint two doorkeepers and to admit to the floor only those whose credentials had been passed upon, in order to exclude improper persons. A call of the roll indicated that 136 delegates were present representing exchanges. Three gentlemen from Pennsylvania held proxies for twenty-seven exchanges in that and other States, and a committee from Tennessee represented by proxy over thirty exchanges.

The first provision of the constitution which was debated at any length was that fixing the limit of assessment for exchanges at 50 cents per telephone and 25 cents per mile of toll line. A motion was made by Judge H. H. Hatch, of Detroit, to amend this by substituting 10 cents per telephone and 5 cents per mile of line. In the debate it was developed that there are now in use between 150,000 and 175,000 independent telephones, supplied by about 1200 exchanges. Secretary Critchfield, of the committee, made an eloquent and able appeal for the higher rate. He spoke at length and

with earnestness of the enormous importance of the movement. He said that the sum resulting from assessments on the basis indicated by the committee would be none too much for the work in hand.

Judge Hatch, replying, said the sum called for was exorbitant. It had been intimated that it was to be used in litigation against the Bell Company. He pointed out the danger of such litigation, and said that he had thought the purpose of the convention was to make a business combination, and not to embark upon perilous litigation.

Mr. S. A. Harper, of Madison, Wis., thought the matter under discussion was fraught with serious consequences. The association should aim to enroll all the independent companies of every sort, and he feared that the larger assessment would keep the smaller companies from joining the association. If all the companies joined the funds would be ample. Mr. Harper said that while it was true that there was danger in the assumption of responsibility in litigation, there was more danger in failing to protect any independent company. He made an able defense of the position he took, and which he assumed to be the desire of the convention.

Mr. Wm. L. Holmes, president of the Detroit Telephone Company, said his company was not prepared to enter any association which contemplated a lawsuit. That, as far as it was concerned, it had nothing to fear from a lawsuit.

The president here suggested that delicate matters would be better discussed in an executive session. A motion for such session was, however, lost.

After further discussion, participated in by Messrs. Stone, of Indiana, Coons, of Illinois, Hatch, of Detroit, and others, the amendment was defeated, and the section adopted in its original form.

At this point, Mr. H. A. Taylor, president of the Standard Telephone Company, of Madison, Wis., made an urgent and forcible appeal on behalf of the manufacturers. He thought that the provision of the constitution excluding them was wrong, and that every man with a dollar to give or a good suggestion to offer should be allowed to enter and take a hand.

After some further discussion, the section ruling out manufacturers, as recommended by the committee, was adopted. Upon motion by Mr. John McGregor, of Madison, Ind., speeches in debate were limited to three minutes.

The next question which the convention debated was that of salaries for the officers. A delegate from Indiana moved to reduce the salary of the president to $1000 per annum. Mr. Coons, of Illinois, offered an amendment to the amendment, making the salary $1500. After a discussion lasting about twenty minutes the section was passed as read. Similar discussions concerning the combination of the duties of the secretary and treasurer and reductions of their salaries, ended in the adoption of the section as presented by the committee.

The section concerning representation was, after some debate, of motion of Mr. Harper, of Wisconsin, referred back to the Executive Committee. At 1 A. M. the session adjourned until 9 o'clock the next morning.

SECOND DAY, WEDNESDAY, JUNE 23.

The convention showed an energetic spirit in assembling promptly for the morning session, which was called to order by President Thomas at 9:30 o'clock. The Executive Committee reported the section concerning representation which had been referred back. The original draft of the section gave only one vote to each member. The amended section allowed one vote for each 500 telephones or major part thereof in use by the member, permitting any exchange, however, regardless of size, at least one vote. An amendment to this, offered by Mr. H. C. Ryan, of Hampton, Va., providing for representation of toll lines on a basis of equivalence of one mile of line for one telephone, was carried. After some further discusion this amended section was adopted.

Judge Hatch, of Detroit, offered a motion at this point to define the sense of the convention as to the representation of manufacturers owning telephone exchanges. Mr. Peter Blow, of Knoxville, Tenn., put in an able plea for non-interference with what he regarded as the private right of owners of exchanges to enter the manufacturing business when they see fit.

Judge Hatch withdrew his motion, and substituted for it one to refer the section back to the committee, with instructions to report an amendment free from all disqualifications to manufacturers. After a long and rather warm debate the whole subject was referred back to the committee without instructions. In a few minutes they reported an amendment striking out the objectionable features of the exclusion of manufacturers, and also making payment of the initiation fee of $10 a sufficient preliminary to entitle delegates to vote at this meeting.

A motion to adopt the constitution as a whole brought Mr. W. L. Holmes, of Detroit, to his feet. He was interrupted by a delegate, who asked the privilege of the floor to move an executive session, but this Mr. Holmes would not grant. He said that he believed the association would be organized on a commercial basis only, and as a means for securing proper legislation. If litigation was not contemplated, what was the need for so large a sum of money? Why were such large salaries paid? He believed it was foolish to advertise that litigation was either feared or contemplated.

Mr. McGregor, of Indiana, wanted to know what would be done if an independent exchange was sued. To this Mr. Holmes replied that the Grand Rapids exchange had been sued three times, and had won each suit.

Secretary Critchfield, of the Executive Committee, made a strong and able defense of the constitution as presented. After some further, rather good-humored discussion the constitution was adopted by an almost unanimous vote amid loud applause.

It was decided, after some discussion, to immediately elect the Executive Committee. Mr. Harper, of Wisconsin, raised the question of the effect of the adoption of the constitution upon the status of the meeting and its temporary officers. The temporary president, Judge Thomas, and Secretary W. J. Vesey were immediately re-elected as temporary officers until permanent officers could be chosen. A vote of thanks was tendered to the temporary Executive Committee. On motion of Mr. A. I. McLeod, of Detroit, the representatives of each State held a caucus to nominate members of the Executive Committee. After a recess of twenty minutes for this purpose a call of the roll of the States showed the Executive Committee to be composed of the following-named gentlemen: West Virginia, D. A. Mossman, Huntington; J. M. Payne, Charleston. Ohio, H. D. Critchfield; Mt. Vernon; Thos. Fricker, Ashtabula. New York, E. E. Summey, Utica; D. C. Dow, Cobblesville. South Carolina, F. C. Manning, Sumpter; R. B. Libby, Charleston. Arkansas, R. J. Jennie, Pine Bluff; W. H. Gladson, Fayettesville. Mississippi, V. L. Terrell, Meridian; C. D. Terrell, Jackson. Maryland, C. E. Fink, Westminster; E. L. Miller, Frederick. North Carolina, T. J. McAdoo, Greensboro; L. A. Carr, Durham. Alabama, J. M. Davidson, Montgomery; F. L. Hawley, Florence. Tennessee, J. C. Duncan, Knoxville; C. L. Hardwick, Cleveland. Kentucky, W. W. Seaton, Ashland; H. K. Cole, Owensboro. Kansas, C. L. Pohlman, Elsworth; Louis Feder, Leavenworth. Iowa, T. H. Johnson, Sioux City; S. T. Slade, Oskaloosa. Wisconsin, S. A. Harper, Madison; Thos. A. Rockwell, Oshkosh. Illinois, Thos. A. Marshall, Keithsburg; I. A. Lumpkin, Mattoon. Michigan, S. C. Higgins, Saginaw; Geo. W. Finch, Escanaba. Indiana, J. L. Howe, Rushville; Hugh Dougherty, Bluffton. Virginia, S. A. Duvall, Richmond; W. K. Lankford, Charlottesville. Pennsylvania, C. R. Savidge, Sunbury; H. C. Young, Columbus.

Immediately after the election of the Executive Committee an adjournment was taken to the steamer "Sappho," which the Detroit Telephone Company had engaged for the entertainment of the delegates and their friends. A delightful lunch and liquid refreshments of a most satisfying character were served on board. The steamer trip, of about 50 miles on the Detroit River, was greatly enjoyed by all who accepted the hospitality of the Detroit Company. Among its other interesting features was the singing of Mrs. K. S. Shafer, the wife of one of the delegates, and of Mr. Wilcox.

The evening session was called to order at 9:45 o'clock, and the Executive Committee reported the following as members of the Advisory Board: Judge C. R. Savidge, Sunbury, Pa.; H. D. Critchfield, Mount Vernon, Ohio; Hugh Dougherty, Indiana; Thomas Marshall, Keithsburg, Ill.; Joseph C. Duncan, Knoxville, Tenn.; Edgar S. Miller, Frederick, Md.; S. G. Higgins, Saginaw, Mich.

It was announced by the President that the Manufacturers' Association had expressed a desire to consult with the association at an early date as to methods to be pursued in the future.

The election of officers then proceeded. Judge James M. Thomas, of Chillicothe, Ohio, was elected president by acclamation, and expressed his thanks in a neat speech. He said that he felt the harmonious meeting at Detroit was a sure indication of ultimate victory. The other officers elected are as follows: First vice-president, Col. H. C. Young, Columbia, Pa.; second vice-president, E. K.

Hines, Oskaloosa, Ia.; third vice-president, Thomas Fricker, Ashtabula, Ohio; secretary, W. J. Vesey, Fort Wayne, Ind.; treasurer, L. A. Carr, Durham, N. C.

Upon motion of Judge E. H. Andress, of Lafayette, Ind., a vote of thanks to the Detroit Telephone Company for their magnificent entertainment was adopted standing.

At 11:45 P. M. the convention adjourned *sine die*, after fifty-one exchanges had joined and signed the constitution.

THE MANUFACTURERS' TELEPHONE ASSOCIATION.

While the convention was in session on Wednesday, sixteen representatives of manufacturers of independent telephones met in the Russell House, Detroit, and formed a national organization, to be known as the Manufacturers' Telephone Association. The officers as elected are H. A. Taylor, of Madison, Wis., president; William Rawson, of Ohio, vice-president; J. H. Lee, of Baltimore, secretary and treasurer. The Advisory Board consists of P. C. Burns, of Chicago; H. A. Taylor, of Madison, Wis., and A. B. Cotton, of Chicago.

This association will work in complete harmony with the other association. It has already begun to raise money for the furtherance of its plans, but for the present is not prepared to divulge the means and methods to be employed in carrying out its objects.

The Independent Telephone Movement.

BY JUDGE JAMES M. THOMAS,

PRESIDENT OF THE INDEPENDENT TELEPHONE ASSOCIATION.

It is an honor to preside over the temporary deliberations of so large and intelligent a body of men, gathered together from all quarters of the greatest country in the world.

We come together to promote the interests of a just cause, and on behalf of the people of this great nation. We know no party, no creed, no State, no North, no South, no East, no West; but the motive that brings us together is as broad as the expanse of our great territory. Having one common object, and that object being pure and right, we have no room for disagreement, and I sincerely hope that during the course of our deliberations we will keep this fact clearly in mind. While we may not all agree as to details, we hope that long and tedious discussions of minor matters will be obviated, so that the work of the convention may proceed with due speed, and an organization be formed before we adjourn that will make still stronger the confidence of the people in this movement. If any came bringing to this meeting motives other than to help take up this great work with zeal and unselfishness, dispel those motives at once, and place yourselves in the ranks of the great army which will win in a short time the greatest commercial victory that this country has ever seen.

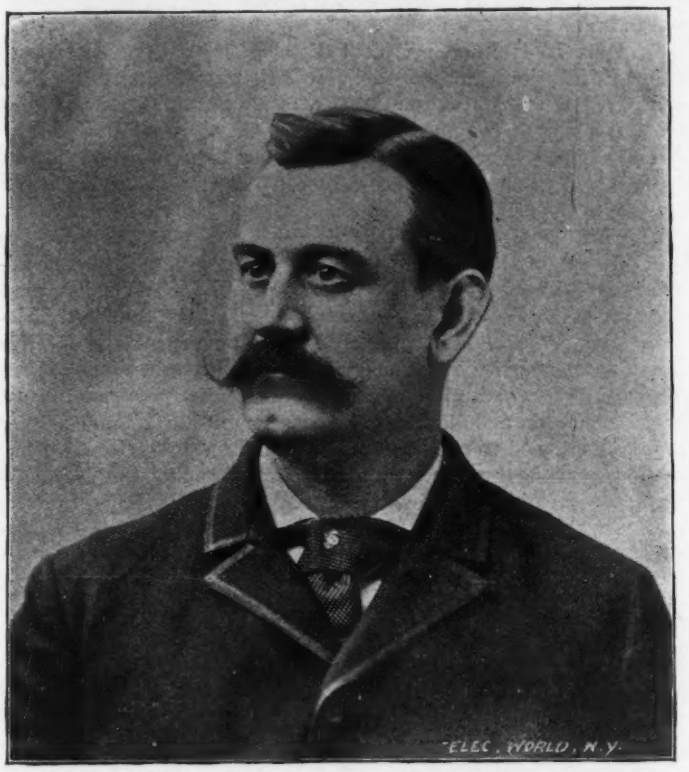
We are told in some of our journals that the telephone business is and must of necessity be a "Natural Monopoly." We answer that, by saying that the people of this free country abhor either a natural or an artificial monopoly as nature abhors a vacuum. It is strange that the American Bell Telephone Company has spent so many millions of dollars in trying to maintain a monopoly, when nature has been so kind as to give it natural protection. If these journals are right, old Mother Nature must have been away from home the past two years, and has forgotten to instruct the boys to look after this natural monopoly in her absence.

We are told again in these same journals that the independent telephone movement has been a failure, and they cite us a few instances where persons or corporations without capital have been so unfortunate as to have executions levied upon their property, and this latter offered for sale by the sheriff. Of course one would infer from these paid articles that this is the only business where such a state of affairs has existed. They apparently forgot that more than 1000 independent telephone companies are to-day doing a successful and profitable business.

It seems to one, after studying the situation and watching closely the movements of the American Bell and its lessees that those companies have not fully comprehended the vast extent of this country. When we stop to consider that up to two years ago there were only comparatively a few people in the United States who felt themselves able to pay for telephones on account of the exorbitant charges made by these companies, and at the same time think of the progress that has been made in the telephone enterprises in other countries, it seems that they have taken a very narrow view of the subject.

There is no country in the world where there is such a great demand for rapid communication as in the United States. Our people are quick to act, always energetic when engaged in any business, and have not the patience to await slow communications. There is always a demand for faster mail trains; there is always a demand for quicker telegraph and more rapid telephone communications, and since it has been demonstrated that the price of telephones can be reduced to a point where the common people can afford, not only to use them in their business affairs, but also in their domestic affairs, the desire for quick communications has been increased to a very great extent. In fact, the people demand this as their right, and any action of the American Bell, under a pretense of still owning fundamental patents, will be met with a very decided opposition by the great masses of the public.

The people have looked forward to the time when, under our patent laws, this invention would be open to fair competition. The people fully believe that this time has arrived. We have been



JUDGE JAMES M. THOMAS, PRESIDENT OF THE ASSOCIATION.

taught to believe that our Government, under our patent laws, protected an invention for a period of seventeen years, and no more. We know that the microphone has been in use more than that length of time, and that the owners of patents upon that invention have had their full protection under the law. Men all over the country who have studied the patent situation know that the rights of the American Bell under its fundamental patents have expired. We claim now the right under our Government to use those inventions for the public good.

Why should these rights be denied us? Or why should the capital invested by men, who are well aware of these rights, be jeopardized and their business threatened by a company whose rights to hold a monopoly under those patents have long since expired. Why should we longer be annoyed by notices and threats made in newspapers to refrain from using this invention? We are unable to explain to ourselves why this state of affairs should go on, and knowing that the great masses of the people are in harmony with this movement, we meet to-day for the purpose of forming a permanent organization for the mutual protection of those who invested their money in this enterprise, as well as the protection of the rights of the great masses of the people.

If we are wrong as to our understanding of the law of this country, and the American Bell still has a right under the Berliner patent of 1891 to a monopoly of the microphone, we will abide the decision of the courts of this country. If we are right, we demand as a matter of right that we be allowed to enjoy the privilege of the use of this invention without further annoyance.

I have never been able to explain why a great corporation should

be so short-sighted as to insist upon something that neither reason nor law guarantees it in trying to hold. It would be far better for the American Bell to concede what might be a right than through even a technicality of the law to attempt to rob the people of that which in reality and fairness belongs to them.

There is plenty of room in the United States for every manufacturer of telephones, for every company that is operating a telephone system or toll line; and if we should all be as industrious for the next twenty-five years as the independent telephone people have been the past two years, our territory would not even then be half covered.

It will be a long time before this country can say that there is one telephone in operation for every eleven inhabitants within municipal districts. Holland can now boast that it has reached that point. How has this been brought about? Simply from the fact that since the invention of the telephone prices charged for the instrument in Holland have been moderate.

If we look into the telephone business in a few other countries, we will find every encouragement to proceed with renewed energy to build up a complete system in this country. The history of the independent telephone movement in Norway and Sweden certainly furnishes great encouragement to those who have undertaken this enterprise in the United States. We are told that in these countries there is in operation one telephone for every seventeen inhabitants within municipal districts.

The Bell Telephone Company was the first to enter the field in these countries. It followed its policy of high prices and independent management, heeding neither the demand nor the desire of the people, and as the result of that policy was able to place only a few telephones in operation. The opposition telephone company came into being, established an exchange in the city of Stockholm at moderate prices, and adopted a policy of accommodating its patrons. In a short time the independent company was operating nearly five times as many telephones as were operated by the Bell at the time the opposition company entered the field. The same thing followed in other cities in these countries, and in a short time the Bell Company was compelled to retire from the city of Stockholm. It sold its property to the independent company for what it could obtain, and the same result followed in the other important cities, until to-day the telephone system of these two countries is owned and in the control of those who in no wise are connected with the Bell Company.

This will certainly be encouraging, and it is safe to predict that unless the Bell Company changes its policy the same result will follow in this country, from the fact that there are hundreds of cities throughout the United States where the lessees of the Bell Company do not receive enough income to pay their employees.

It is a remarkable fact that for more than two years the independent telephone exchanges in hundreds of cities throughout this country have continually increased their business, while the lessees of the Bell Company have been furnishing telephones free to anyone who would allow them to place one in his residence or place of business. This is certainly an indication of the feeling of the people. I have often wondered if the American Bell fully realized this state of affairs. If it does, it certainly has food for thought. There is always some reason when a man will pay for something that he has an opportunity to receive for nothing.

There has been more than $20,000,000 invested in the independent telephone enterprise in this country, but a greater capital stock than all this money is the fact that we have the sympathy of the people, and have in every locality, where a successfully managed independent telephone exchange exists, a local influence which can never be taken from us so long as we do our duty, give good service and subserve the wishes of the citizens.

A GROUP OF DELEGATES TO THE INDEPENDENT TELEPHONE CONVENTION.

It was predicted by every important journal in this country in the early days of the telephone that it would succeed and do away with the telegraph. The Western Union Telegraph Company must have believed that this prediction would come true, for we find it in the lead to get control of patents. It seems that it linked its fortunes with Edison, while Bell, Blake and Berliner were gathered in by the American Bell Telephone Company.

Then after a brief struggle for the telephone field, we find an agreement was made between these two great corporations, in which it was provided that one should retire from the telephone field and should receive in consideration millions of dollars. So the prophets' prediction failed. The telegraph business continued as before.

The telephone was conducted so quietly that the people never dreamed of the immense fortunes which were being accumulated under these patents and under these arrangements until their attention was called to it by this independent telephone war.

We believe that the contract made between the Western Union and the American Bell has done more to retard the universal use of quick communication than anything that has happened since the invention of the telegraph and the telephone. So soon as this battle is over, the people will be surprised at the growth which rapid communication will make. Messages will be transmitted over telephone wires and recorded at the receiving end, delivered to the

party addressed and the answer returned, recorded and delivered without causing people to wait for lines and to get parties to the phone. Time will be saved, more words will be transmitted at the same expense, and the commercial world will feel the advantage of this form of communication.

It will not be long until the telephone is a very essential feature of our post office department. So much letter writing is burdensome, and with all the advantages of our fast trains we are impatient with this manner of communication. We would be better pleased and time would be saved if for a reasonable sum of money we could talk to those with whom we have business or with whom we desire to communicate. Taking, then, the vast territory, our population of 70,000,000 of people, this great and growing demand for quick communication and the probability that it may in the near future be adopted as the greatest department of our postal system, the field is so great that it seems folly for one company or one corporation to stop progress by giving time to quarreling, contention and litigation. There is still room for more to enter this great field, and one need have no fear of competition in the next half century.

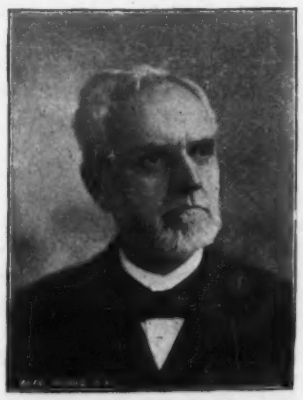
If, however, there is not in this view of the case sufficient to exact peace, then let the war go on! The American Bell Telephone Company will find that this battle will be its Waterloo. It will find that others have been thinking while its officers have been scheming to make money. It will find, too, that our courts will uphold the law as the law if brought under the state of facts proven. It will find also that it will not be trying the suit of the Government nor the cancellation of a patent. It will be shown to the courts and that the courts will decide as the judges presiding over them are bound to do under their oaths according to the law and the facts. And while the American Bell may boast of its victories while it says nothing of its numerous recent defeats; and while it may boast of its great technical lawyers, of its millions of money and of the numerous expert witnesses it has retained; still, it will find that in this great country there are others equally as learned who are ready and willing to espouse the cause of the independent telephone movement, knowing that a great victory will reward their efforts. It remains, then, for the American Bell to say what policy it will pursue, but it should understand that whether it be in peace or in war we will meet it, and in peace will greet it, in war will surely defeat it.

The Berliner Patent and the Government Suit.

BY JUDGE R. S. TAYLOR, CHIEF COUNSEL FOR THE GOVERNMENT IN THE BERLINER CASE.

The last public gathering which I attended in Detroit was the Presbyterian General Assembly. It is only just that I should say I was not a member. That body has enough to answer for without being responsible for me. When I was present they were discussing the Dr. Briggs case. They were trying to discover some way of putting a check upon what was regarded as unwholesome free speech. Now I come to Detroit to attend a convention, the purpose of whose assembling is to promote free speech. (Applause.) And I like to be at this one a little better than the other.

We are met, gentlemen, under somewhat peculiar circumstances in some respects. I do not know what better I can do than to go back to Scripture again for an illustration. You will see in a moment that I did not attend the General Assembly for nothing. We are told in Scripture that a man named Jacob made a contract once to work on a stock farm seven years for a wife. It was a large price to pay for a wife. They are cheaper now, That is they are cheaper to get, but more expensive to keep. (Laughter.) Well, Jacob worked out his seven years, and was going down town to get a license when the old stock raiser sprung another girl on him, a back number that he had over, and told him that if he wanted Rachel he must work seven years more. I think that transaction has been regarded ever since as one of the most atrocious frauds ever perpetrated upon unsuspecting man. (Laughter.) Well, now the American Bell Telephone Company has been the most successful stock-raiser that ever sheared lambs in the United States. (Laughter.) It made a contract with the American people, that if they would work for it seventeen years they should have a free telephone. The people worked the seventeen years, and now the Bell Company springs a back number in the shape of another patent for seventeen years more, which they must put in if they want "Rachel."



JUDGE R. S. TAYLOR.

Taking it altogether, I think this is the most extraordinary transaction ever presented in history. I know of no invention made within the last fifty years which touches the people so closely in their lives and their happiness as the telephone. We are told that life is not to be measured by years, but by what you can do and enjoy in it; and that facility of instantaneous and universal communication, which, in fact, adds new faculties of speech and hearing to the human organism, does more to add to the possibilities, accomplishments and enjoyments of life than any other one invention I can think of made within fifty years past. In this I comprehend not only what the telephone is and has been, but what it is ready now to be, provided the people can have that enjoyment of it which they have paid for, and which the law has promised; and the people have paid for it the largest price ever paid for any one invention that I know of. There may have been more dollars paid for other forms of electrical apparatus, but they comprehend costly and valuable machinery. If you take my proposition as I state it you will see it is true that the American people have paid more money for the telephone, for the invention in it, than they have paid for any other invention made within fifty years past.

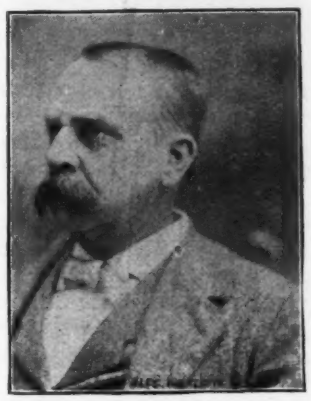
Now, I do not know that these remarks are at all germane to this convention. I have been led into them because they relate to a topic which has at this moment much interest in the minds of the public, and particularly in the minds of those connected directly or indirectly with telephone service.

Our friends of the newspapers, who always lay down our programmes in advance for everything which we propose to do, and to whom we are under more obligations than we can express, have in some quarters given the public to understand that this convention assembled for the purpose of fighting the Bell Telephone Company. Well, I do not know what this convention could do about it. I suppose if somebody would offer some very denunciatory resolutions they would receive cordial support at the hands of this convention, but this convention, as a convention, or as a body of men, is powerless to do anything to affect the situation, which is at the same time interesting to us all. And so, while I suppose the subject may be entirely unconnected with the purpose of this convention, inasmuch as some erroneous and disturbing impressions have been spread abroad as to the situation, and particularly inasmuch as I do not know what else to say, it occurred to me that it might maybe occupy agreeably a few moments of your time in speaking of this situation.

You have, of course, heard about the Berliner patent. You have heard doubtless, also, of the suit brought by the United States Government to repeal that patent, and of the result of that suit, and you may have received the impression which has gone out in some quarters that by the decision of that suit the validity of that patent had been in some way established, so that it had a pledge or promise or probability of disastrous effect upon the independent telephone interests of the country, and now upon that subject it is quite desirable that you shall know the truth as it is, and that you shall not be disquieted in your minds on that subject any more than is necessary.

Now, the Berliner patent was granted in November, 1891, and expires in 1908. There was just one feature connected with this issue which led the Government of the United States, represented by the Attorney-General, to bring suit to have it set aside, and that was the length of time during which the application had been held in the office. The application was filed in June, 1878, and the patent issued in November, 1891, nearly fourteen years afterwards. During that period the Bell was enjoying a patent monopoly of the instrument covered by the patent, which is the microphone transmitter. That instrument was protected in the hands of the Bell Company by a large number of patents. If you have ever had your attention called to it, you may have observed stamped on one side of the Blake transmitter a long list of patents upon the instrument, so that during all those years, and particularly from 1881 to 1891, the Bell Company had no need of any further patents on the microphone transmitter. At the same time the claims made in the Berliner application were of such a fundamental character that if the patent could be obtained upon them and they could be sus-

tained, they would absolutely control the use of the microphone until the expiration of the patent, so the application was continued in the office from year to year, and from year to year until, as I have said, 1891, when the Bell patents were just about to expire, and other patents were nearing their termination. Now, this delay in the office looked so much like design; it had so much the appearance of an intentional delay, that the President of the United States directed that suit be brought to test the validity of the patent, and this was done upon the idea that the patent was a manifest wrong upon the people; that if it was granted contrary to law it ought to be set aside; that if it was granted by authority of law, the law ought to be changed, and that nothing would be so sure to bring about a change of the law as to let the people see this example of its injurious operation. Now, there were connected with this patent a great many questions affecting its validity. It

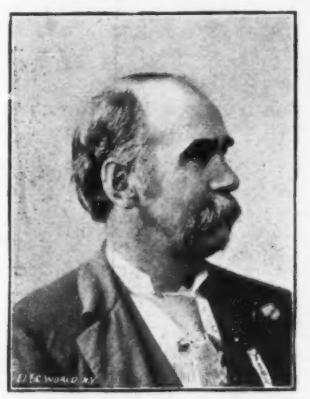


1ST VICE-PRESIDENT H. C. YOUNG.

JAMES E. KEELYN.

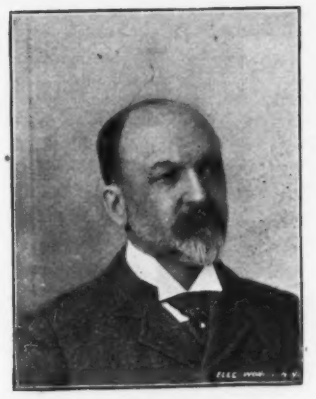
P. C. BURNS.

H. C. DODGE.



I. H. LUMPKIN.

JUDGE C. R. SAVIDGE.



JUDGE E. H. ANDRESS.

GEORGE W. BEERS.

SOME OF THE PROMINENT ATTENDANTS AT THE CONVENTION.

was and is open to a great many objections; half a dozen, I believe, and some of these objections were put into the bill filed by the Government, but the main point urged and argued was that the patent had been obtained in bad faith; was delayed in the office, when it could have been taken out at an earlier date, and this was raised upon the proposition that the Bell Company, which owned the application from 1878 until the patent was granted, having in one hand a dozen patents on the microphone transmitter, and having in the other hand an application for another patent on the same thing, which would control the monopoly for another period, was bound to take out this second patent as soon as it could get it. That was the fundamental question.

You are all of you, I take it, more or less familiar with the history of the case. You know that upon the trial of the suit in the Circuit Court of the United States in Boston the Government suit was sustained and the patent was found to be invalid, upon the point which I have just stated, and upon one other, which I will speak of in a moment. The case was appealed to the Circuit Court of Appeals, where the decision was reversed. From the Circuit Court of Appeals the Government appealed to the United States Supreme Court, where the judgment was affirmed. Now the judgment of the Supreme Court of the United States decided this: It decides that the one primary proposition upon which the Government should rest, that the Bell Company owed a duty to the people in regard to its application, was not well taken. The Supreme Court declined to consider any other question, and decided that it was not within the jurisdiction of the courts of the United States to entertain any application of the Government to set aside a patent upon any ground upon which a private citizen could defend an action of infringement, and decided further that the applicant in the Patent Office was entitled to get all the advantage he could by delay of his application, if it came through the act of officials of the Patent Office, through their ignorance, or carelessness, or indifference, or anything else, except his own affirmative, specific, personal fraud. That is, that so long as he did not by any word or act of his own deceive the commissioner; did not by any affirmative word or act of his own cause the delay, he was entitled to all the benefit of all the delay he could get.

Well, gentlemen, I am sorry for the decision. I think you will all believe that. I did what I could to prevent it, but I am not surprised. I made some remarks upon this subject some time ago, before the decision, in the hearing of some of you—I do not know how many, but a few, I know—and I remember saying to you at that time that you must not be surprised if the decision of the court should be exactly what it has been,

The proposition urged was an entirely new one. There was no precedent for it. No patent had ever been set aside on that ground. It was an entirely new ground to take, and the decision is an illustration of the fact that a thing which is inherently, morally right and just is not always the law. We wish that it might be, but all lawyers must admit, and all lawyers know by their own experience that it is not quite enough to show in court that a thing is right, but you must have something to show in the way of law or decision, which will back up your claim, or you are very liable to slip down. This, I may say further, is the first case ever brought to a final hearing in the Supreme Court in which it was sought by the Government to set aside a patent, and I do not risk very much in saying that it is the last one. The decision of the court that no question will be entertained at all which can be raised by a private citizen in a suit for infringement, restricts the grounds practically to one, which is fraud, and a further decision that that fraud must be proved by the same kind of evidence, and the same amount of evidence which will set aside a horse trade makes it impossible

to make the proof. The patent sharps who control matters of that kind are not such awkward fellows as to make that kind of blunders, the law being now that any sort of introduction in the Patent Office by which you get the patent does not count, so long as you are not caught at it. Men won't be caught at it, so that I think I may say with some sort of truthfulness that in this suit the United States Government has probably had its last experience of the kind. It will be hereafter for the people themselves to find out questions which arise upon the validity of patents, and in respect to this particular patent the decision of the court has left it exactly where it was when the patent was issued. It is to the effect that the validity of this patent is to be tried in precisely the same way, by precisely the same proceeding upon which the validity of patents generally is tried, and nothing which has been said or done by the Supreme Court puts any obstacle or adds any embarrassment whatever to the full, thorough and complete trial of all questions which can be raised, or which ever could have been raised, in regard to the validity of this patent, leaving out alone the single question of delay in the office, a question which cannot and never could have been tried in a suit against a private citizen for infringement.

Now, I say this much, as I said before, because I think the people who are using independent telephones and the people who are furnishing them to their neighbors are entitled to know the precise status of the case. The attempt made was to set aside this patent by a short cut; to save the people the necessity and the trouble of defending themselves against it by the influence of various grounds that exist, by putting it out of the way on this particular ground. The failure of that attempt has left the case right where it was before, and, as I have elsewhere said, the suit itself has been a great advantage to the public, because it has held the Bell Company at bay for four years, giving the independent companies time to organize; the people time to become intelligent on the subject, and the movement time to get strength; and, more than that, the testimony taken in the case has been put upon record, as well as a great many facts of importance to persons who desire to prevent infringement. There have been witnesses examined in the case whose testimony has been put upon the record so that none can get away from it, which is a circumstance of the utmost importance for all who may be called upon to defend a suit under the patent.

Now, I want to say further that I have said all that I feel I ought to say. But I feel about this thing as one of the public. I am simply here as a citizen. I have an independent telephone in my house. I sympathize with the movement in our town. I believe that it is a matter of the utmost importance to the advancement and development of the material interests of these United States that the telephone should at once become the property of all the people. We have not begun to understand what it is good for. The instrument itself is so simple. It costs so little money. It is so easy to handle and manufacture that it ought to be in every house; it ought to be in every house in town, and many a house in the country. It ought to be in every hotel, in the office, and in every room. It ought to be in every factory, from the superintendent's desk to the various parts of his factory. Why, the number that ought to be used in this country runs into the millions and millions, and every one of them, as I have said, would do something to lengthen life, by its enjoyment. (Applause.)

We have come to the time when the enjoyment of the telephone ought to begin, and as a citizen of the United States and of Indiana, concerned as I am in the material, social prosperity of the people, I am interested in this matter with you and with all others, and so I say it is a matter of individual concern to me that nothing shall happen which shall stand in the way of this immediate and widespread development of the art of telephoning.

For my own self, it is impossible for me in my own bosom to be afraid of the Berliner patent. I have confidence in justice and truth, in the final victory of that which is right, which bears me up under all circumstances. I know a good deal about this patent, and it is without any sort of question the most unblushing, barefaced, thinnest, inexcusable, abominable fraud that ever received the sanction of government. (Applause.) It has not one single redeeming feature about it. It did not give the world one single idea about the telephone. It did not advance the progress of the art one minute. The telephones of to-day are just exactly what they would have been if Emile Berliner had never been born. There is not underlying it one single particle of merit, not a particle. Nobody has ever said there was, not even counsel for the Bell Company. No court has ever decided that there was. The only court that has ever said a word about the legal validity of the patent was the Circuit Court of the United States for the District of Massachusetts, and it decided it was void. The Supreme Court of the United States did not undertake to stay that it was honestly obtained and was a valid patent. It went no further than to say that for this particular reason this court will not interfere; everything else was left out.

That the patent was in fact nursed in the Patent Office, held from year to year, for nine years, perhaps to extend its life, is a thing which I said nobody who ever looked into the records doubted for a minute. The Supreme Court and the Court of Appeals did not decide that it was not so. No one has ever said so, except the attorneys for the company in their argument, and they immediately knocked all that out by saying that it is no matter if there was delay; it would not affect the case if there had been.

Now, I am unable to believe, gentlemen, that the courts of the United States will sustain and enforce for all the period of years which that patent has to run such a monstrous wrong upon the people. I cannot believe it. And yet I do not want you to take my word for anything at all. I am excusing my presence here. I am excusing myself for some things I have said to some people who have asked me questions.

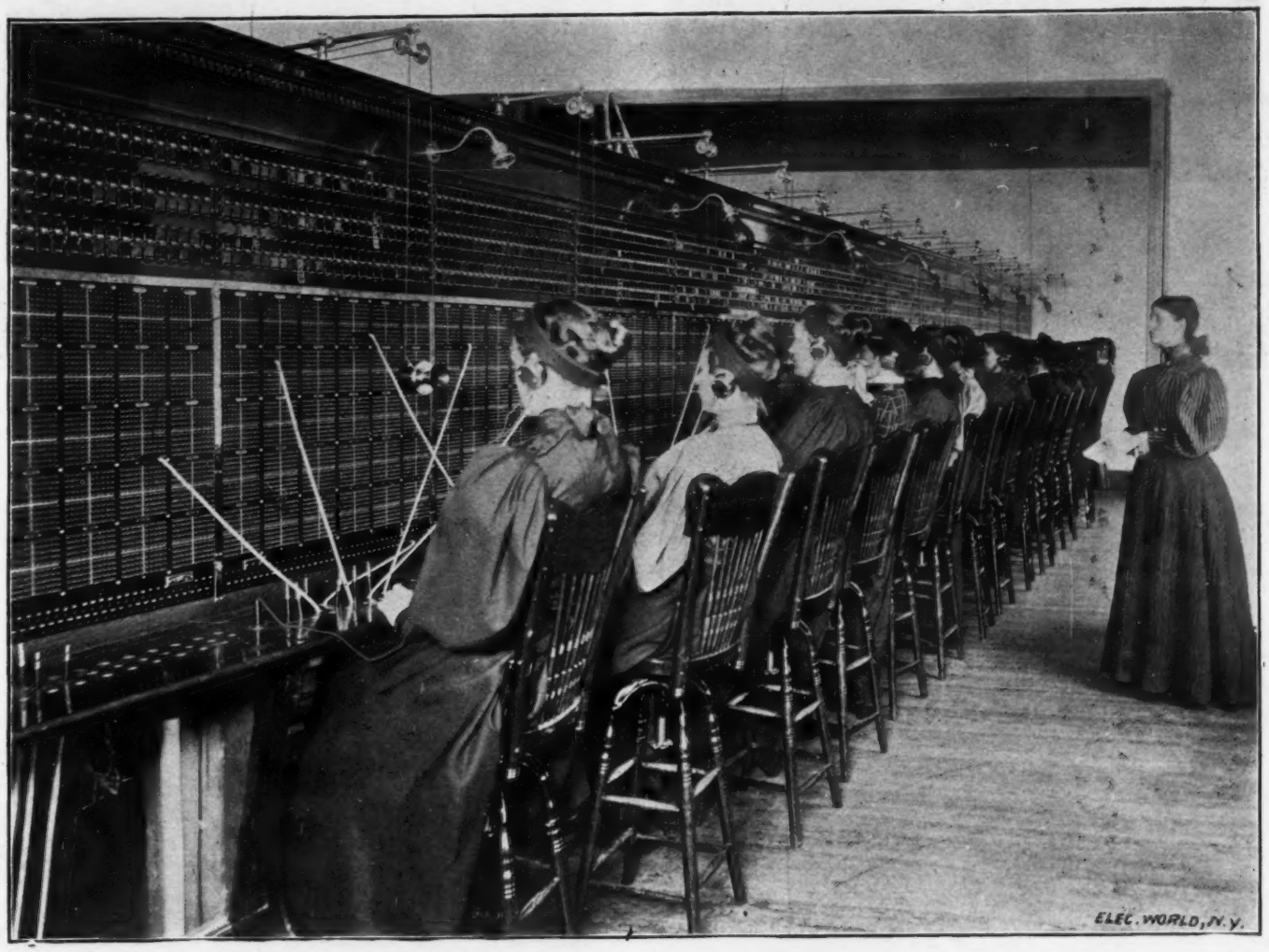
An acquaintance of mine, who is interested in an independent telephone company, wrote me some days ago for advice as to what he should do. He had bought some telephones. The time had come to pay for them; to put them in, or give up those he had. I said to him: "Pay for them; put them in; go ahead; do not be a coward; the Lord and justice are on your side, and you will probably come out all right," (Applause.)

All this talk, however, is aside from the proper purpose of this convention. I have alluded to these things merely because I know they are in your mind. I know they have been talked about, and there has been some misunderstanding in regard to them, and I thought you should have what I believe to be the truth upon this subject.

Now, you are met together as a representative commercial convention; have come together as representatives of a common business and a common craft, which has obtained a foothold throughout a large part of the United States, and you have done wisely, I think, to do so. To come together and organize is part of the American instinct of self government.

When several hundred men have embarked in business of a common character throughout the United States, they generally come together, organize, adopt by-laws, elect officers and set up a sort of government—that is what it is—among themselves; it is the instinct of the Anglo-Saxon race. It breaks out upon the playground in the school, and it follows men in this country until they die. Now, this convention of yours, as I see it, has some very prominent purposes to subserve, and I place in front of these the exchange of views and the dissemination of information from one to another. Your interests generally are all identical. It is to the interest of everyone of you representing a local exchange that the local telephone exchanges of the United States shall all thrive, and all give public satisfaction and all do good. (Applause.) There is no rivalry or antagonism of interest between you. When a man who is a subscriber to an independent line in Detroit comes to Fort Wayne and finds an independent line there it does him good to use it. He feels at home with that kind of telephone, and it makes him feel happy to find that it works; that he hears distinctly. It does him good to hear from our citizens that our line is doing well, giving satisfaction—better than the old one. Now, this is a business in respect to which there is much to be learned by experience, in a great many ways; much to be learned in a mechanical way; in regard to the location of lines; distribution of lines; insulation of lines; putting lines underground; what kind of conduits; protection of lines from induction, from other sources of electricity; the organization of an exchange; the employment and management of operators. One of the most delicate things in this world, gentlemen, is to handle girls. (Laughter.) Now, our Mr. Beers, down here at Fort Wayne, and he is mighty slick at that, has found out, or thinks he has found out, some way to control his girls that is an advantage over the old method, and he ought to let you people in Detroit know about it; it ought to be scattered everywhere. The experience that is gathered by the actual operation of these systems ought to become common property.

I will only mention one other thing, and that is the influence which you may be able to have upon legislation. There ought to be amendments and improvements made in the patent law. I know of no body of men or organization which will have so much power to secure that kind of reform as this association. Your membership is scattered throughout the entire United States. You have behind you thousands of citizens who are using your instruments; they are all your friends, and all on your side, and you can influence and control members of Congress and Senators, as no other craft or body of men can, and for that alone, for the purpose of studying the defects of the patent system, and bringing them to the attention of Congress, and receiving information upon them, you may have a power for good which no man can estimate, and which alone will justify the maintenance of your organization. Now, gentlemen, I did not intend to detain you so long, but it has been your fault as much as mine; you have been too complaisant with me. I can only say this: I wish from the bottom of my heart your organization and your association success. If you shall go on as you have done, and contribute as effectively as you have begun to make the telephone an everyday, everywhere accompaniment of American life, you will be benefactors of the United States in your business, such as no single body of men have been or can be.



A PART OF THE SWITCHBOARD OF THE DETROIT TELEPHONE COMPANY.

The Detroit Telephone Company.

The largest independent telephone exchange in the world is that operated by the Detroit Telephone Company in the city of that name. Its switchboard, of which the accompanying illustration shows a small part, is 176 feet long, and has accommodations for 6000 metallic circuits. This magnificent switchboard is arranged in eighty sections of 150 drops each, each section requiring two operators. Over 3000 subscribers are now connected, and the work of connecting others is being rapidly pushed. An average speed of less than 15 seconds to a connection, with comparatively untrained operators, is now attained. A branch exchange of 1000 subscribers is now being rapidly installed, and two more similar exchanges are now being planned.

The lines of this company are run in conduits in the business portion of Detroit, cables of 100 circuits being uniformly used. The telephones operated are manufactured in Detroit under its supervision.

A new system of automatic registry and restoring push buttons, which will soon be added to the board, will make it one of the most complete in existence.

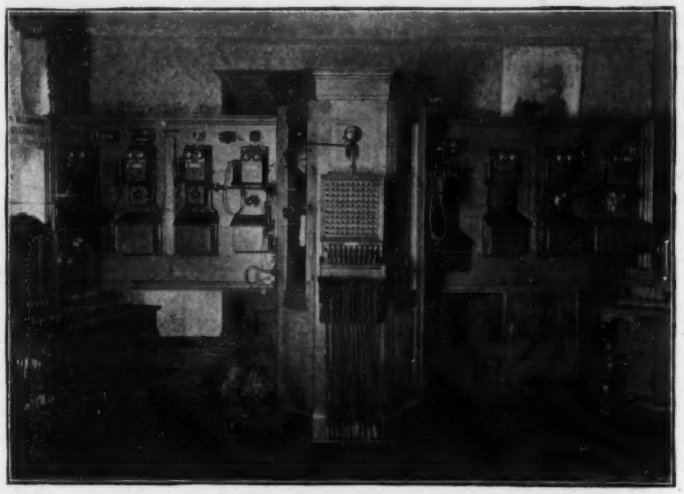
Mr. W. L. Holmes is president of the Detroit Company, and Mr. T. F. Ahearn is its general superintendent and engineer.

The President of the Independent Telephone Association.

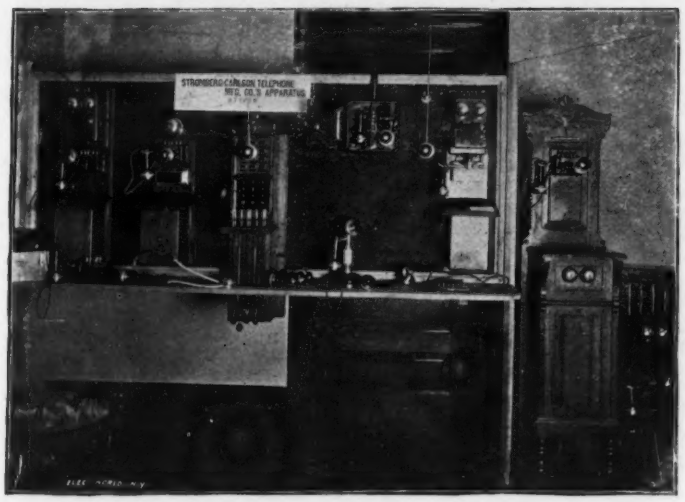
Judge James M. Thomas, who was elected president of the Independent Telephone Association at the Detroit convention, June 23, is in his thirty-ninth year, has practiced law for fifteen years and been on the bench four years. He has paid considerable attention during that time to patent law and litigation. He became interested in the independent telephone movement just before the expiration of the fundamental Bell patents, and made the patent situation a study for some time before becoming financially interested in the building of exchanges. He has always been convinced, he says, that the claim of the American Bell for further protection under its patents was nothing more than an effort to frighten capital in order to weaken opposition. He holds the opinion that the suit brought by the Government against the American Bell was a great mistake, and the thing desired by the Bell Company. The effect that the decision has had, he believes to have been a great disappointment to that company, for the reason that it has had no noticeable influence upon the independent movement, except that it has been the cause of what he considers one of the strongest commercial organizations that has ever been formed in this country. That organization, he thinks, will have the backing of nine-tenths of the people of the United States, and the result to the American Bell he

believes will be disastrous. Judge Thomas has paid considerable attention to organization of different enterprises, and believed when he became interested in the independent telephone movement, and still believes, that it is the greatest field for investment now open to the American people. He considers that it has already been demonstrated in the independent telephone business, as in others, that reasonable prices and fair dealing are essential to complete success.

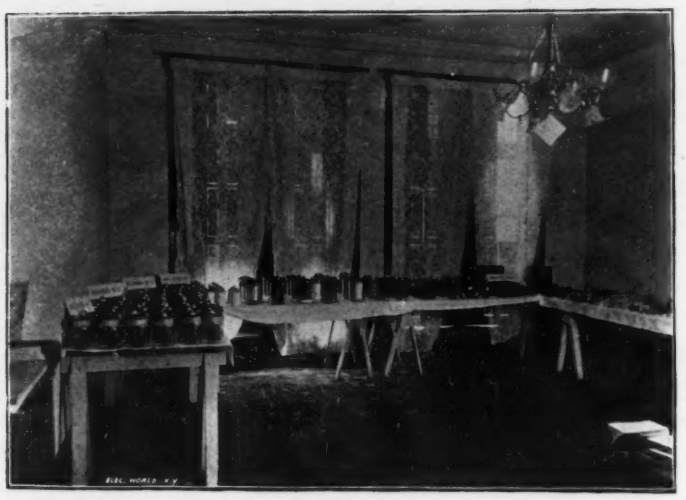
The Keystone Telephone Co.'s Exhibit.



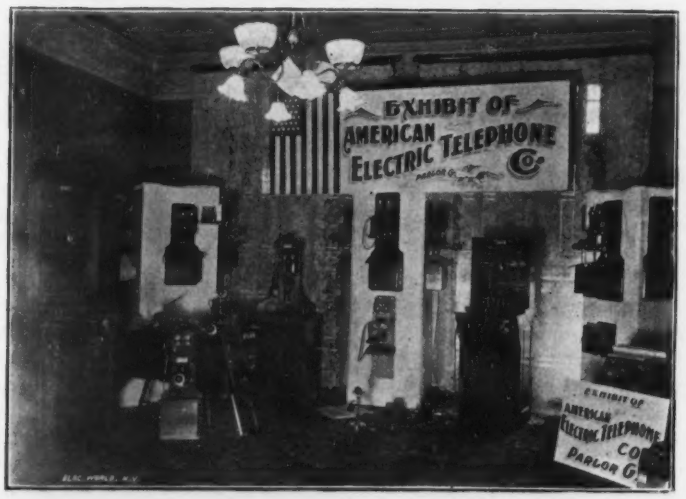
The Western Telephone Construction Co.'s Exhibit.



The Stromberg-Carlson Telephone Mfg. Co.'s Exhibit.



The National Carbon Co.'s Exhibit.



The American Electric Telephone Co.'s Exhibit.

The Williams-Abbott Electric Co.'s Exhibit.

SOME OF THE EXHIBITS AT THE DETROIT CONVENTION.

Constitution of the Independent Telephone Association of the U. S. A.

ARTICLE I.

NAME.

The name of this organization shall be the Independent Telephone Association of the United States of America.

ARTICLE II.

OBJECTS.

The objects of this Association shall be:

1. The protection of all independent telephone interests of common concern to the members of the Association.

2. The protection of subscribers to telephones and apparatus operated by members of this Association.

3. The bringing about a reasonable charge for tolls and the rental of telephones, so that the telephone may be within the reach of the masses of people.

4. The bringing about a complete system of inter-municipal communication and long-distance trunk lines.

ARTICLE III.

MEMBERSHIP.

Any corporation, partnership, or individual, engaged in the operation of an independent telephone exchange, toll line, or system, may become a member of this Association by complying with the following conditions:

1. The payment of a membership fee of $10.00, and the first assessment levied as hereinafter provided; provided, however, that the payment of the membership fee and signing the constitution only shall entitle the member so paying to vote in the election of officers, upon the adoption of this constitution, but not thereafter.

2. The payment, from time to time, of such further assessments as the Association, through its proper committee, may levy, not to exceed in any one year fifty cents for each telephone in use by any exchange or toll line company, and fifty cents per mile of pole lines, carrying a wire or wires, over which paid messages are transmitted.

3. Any corporation, partnership or individual engaged in the manufacture or sale of apparatus or materials used in the construction, operation or maintenance of an independent telephone exchange, toll line or system, may be called upon by the Advisory Board for such voluntary contribution as in the judgment of said Board may be equitable and necessary, and upon payment of the same, shall, at the option of the contributing party, be made an honorary member of the Association. The Secretary shall make monthly report to the President, the Advisory Board, and the Executive Committee, and an annual report to the Association, of the persons, firms, or corporations entitled to honorary membership under the provisions of this Article, and the amount contributed by each. The receipt of the Secretary shall be the certificate of such membership, but honorary members shall have no voice in transacting the business of the Association, as a matter of right.

4. By subscribing to the constitution and by-laws of the Association.

ARTICLE IV.

OFFICERS.

The officers of this Association shall be a President, three Vice-Presidents, a Secretary, two Assistant Secretaries, a Treasurer, and an Advisory Board, consisting of nine members, two of whom shall be the President and Secretary of this Association, together with seven members, who shall be selected by the Executive Committee. The President and Secretary of the Association shall be ex-officio Chairman and Secretary of the Advisory Board and Executive Committee, respectively.

ARTICLE V.

COMMITTEES.

The Association shall elect an Executive Committee, which shall consist of two members from each State, each State, through its delegates, to suggest the names of the members of said committee to represent such State. Should any State be without representation in the convention, the convention shall then select two members from such State, who shall act until the vacancy shall be properly filled under this Article. The Executive Committee shall, with the consent of the Advisory Board, select such sub-committees as it deems expedient and necessary, and shall fully empower such sub-committees to carry out the objects for which they were created.

ARTICLE VI.

DUTIES OF OFFICERS.

1. The President shall preside at all meetings of the Association, Advisory Board and Executive Committee. He shall, under the direction of the Advisory Board, conduct a bureau of information for the benefit of members of this Association, and shall, with the assistance of the Advisory Board, collect all data and information relating to the welfare and promotion of independent telephone interests. He shall procure facts and evidence tending to the protection and promotion of such interests. He shall have power to call to his assistance for consultation the officers, committees and members of this Association. He shall approve and countersign all orders drawn on the treasurer of the said Association; shall approve and sign all contracts and bonds made by this Association; shall approve all bonds made to this Association, and be custodian of the same, and shall perform such other duties as naturally devolve upon his office. He shall receive such salary, not to exceed $2,500 per year, as the Executive Committee shall fix; shall have an allowance for expenses, to be paid upon approval of the Advisory Board on presentation of properly executed vouchers. His salary shall be paid at the end of each quarter by draft made on the Treasurer. He shall give bond in such sum as the Executive Committee may require, with such security as may be approved by the Advisory Board.

2. VICE-PRESIDENTS: The Vice-Presidents shall rank first, second and third, according to the choice of the Association, to be designated at the time of their election, and shall, in their order, perform the duties of the President so far as they relate to meetings of the whole Association only, in the absence or inability of the President to act, and shall have an allowance for actual expenses, while performing said duties, upon the approval of the Advisory Board.

3. The Secretary shall keep the minutes of the Association; he shall collect all moneys, receipt for the same, and turn the same over to the Treasurer promptly, and take his receipt therefor. He shall keep an accurate account of all receipts and expenditures of money, and make a report at each annual meeting of the Association, and to the Executive Committee and Advisory Board whenever called upon so to do. He shall issue and mail all official calls and perform all other duties required of him by the Association. He shall receive such salary, not to exceed $1,000 per year, as may be fixed by the Executive Committee, and shall have an allowance for expenses, to be paid upon the approval of the Advisory Board on presentation of properly executed vouchers. His salary shall be paid at the end of each quarter by draft upon the Treasurer. He shall give bond in such sum as the Executive Committee may require, with security to be approved by the Advisory Board.

4. The Assistant Secretaries shall rank first and second, according to the choice of the Association, and shall, in their order, perform the duties of the Secretary in his absence or inability; and perform such other duties as the Secretary may require of them, but shall not be members nor act as Secretary of the Advisory Board. They shall have such compensation as the Advisory Board may designate, and an allowance for actual expenses while performing the duties of their office, to be approved by the Advisory Board upon presentation of properly executed vouchers.

5. The Treasurer shall receive from the Secretary all money by him collected, acknowledge receipt thereof, and pay all properly executed orders and drafts, provided for in this constitution, and all other orders signed by the Secretary and countersigned by the President, under the direction of the Advisory Board. He shall keep an accurate account of all moneys received and disbursed, and make an annual statement of the same to the Association, and an itemized statement thereof to the Advisory Board at any time when he may be called upon so to do. He shall receive such salary, not to exceed $750 per annum, as may be fixed by the Executive Committee, and shall have an allowance for his actual expenses, after the approval of the Advisory Board, upon presentation of properly executed vouchers. His salary shall be payable at the end of each quarter, by draft upon himself as Treasurer. He shall give bond in such sum as may be required by the Executive Committee, with security to be approved by the Advisory Board.

6. ADVISORY BOARD: The Advisory Board shall have full power to determine all questions, transact all business of the Association at all times when the Association or the Executive Committee are not in session; but shall carry out the policy adopted by the Association, or the Executive Committee, unless, in the opinion of the Advisory Board, circumstances make a change of policy desirable. The Advisory Board shall direct the finances of the Association, shall have full power to levy assessments whenever necessary, subject to the limitations contained in Article III., and to appropriate money in the general fund to such use as, in its judgment, is essential to the welfare of the Association. It shall create two funds in the hands of the Treasurer, first, a fund for salaries and expenses of officers and committees; second, a general fund; and shall have power to transfer money from one fund to the other without interfering with existing obligations. It shall contract for the Association, and shall at all times, except when the Association or Executive Committee is in session, direct the other officers of the Association to carry out the intention of this organization.

7. The Executive Committee shall have all the power of the Association, except when said Association is in session, not herein especially delegated to the officers and Advisory Board, and shall have an allowance for their actual expenses incurred in attending meetings of the Executive Committee, after presentation of properly executed vouchers, upon approval of the Advisory Board.

ARTICLE VII.

REPRESENTATION.

Each member of this Association shall be entitled to one vote for each 500 telephones or less, or for each 500 miles of toll line or less, in actual use, and one additional vote for a major fraction of 500 telephones or miles of toll line in actual use; and no more, on the election of officers or as to any question voted upon by said Association.

ARTICLE VIII.

QUORUM.

A majority of all members present shall constitute a quorum for the transaction of business of this Association, twenty days' written notice of the time and place of holding the meeting having first been mailed by the Secretary to each member of the Association.

ARTICLE IX.

EXECUTIVE COMMITTEE QUORUM.

Ten or more members of the Executive Committee shall constitute a quorum for the transaction of business, ten days' written notice of the time and place of the meeting having first been mailed by the Secretary to the address of each member of the Committee.

ARTICLE X.

ADVISORY BOARD QUORUM.

A majority of the members of the Advisory Board shall constitute a quorum for the transaction of business.

ARTICLE XI.

SPECIAL MEETINGS.

The Advisory Board shall, whenever in its opinion the same is desirable, through its President and Secretary, call special meetings of the Association or the Executive Committee, at such times and places as it shall designate, and a special meeting of the Executive Committee shall be called by the Secretary upon the written request of three members of said committee, stating the object for which the committee is called, filed with the Secretary at least twenty days prior to such meeting. The Secretary shall thereupon notify each member in writing of the time and place of holding the meeting, and shall mail to each member a copy of the request for the same. A special meeting of the Association may be called upon a written request therefor, stating the object for which the meeting is called, being filed with the Secretary, when signed by not less than ten 100 members of the Association. The Secretary shall give ten days'

written notice of the time and place of holding such meeting and shall mail to each member of the Association a copy of the call for the same.

ARTICLE XIII.

SPECIAL MEETINGS.

Any member of this Association who shall perform special services under the direction of the Association, Executive Committee or Advisory Board, shall be allowed such compensation and allowance for expenses as shall be approved by the Advisory Board.

ARTICLE XIV.

ELECTIONS.

The election of officers shall be by ballot, whenever two or more names are presented for the same office, and shall be conducted by three judges and two clerks, to be selected by the presiding officer. The presiding judge shall announce the name of the voter before the ballot is deposited in the ballot box, and should any member challenge the vote, the judges shall then proceed to hear the objection and shall determine the rights of the voter. Members may vote by written proxy, duly authorizing another member or representative of a member to cast the ballot.

ARTICLE XV.

AMENDMENTS.

This constitution may be amended at any regular meeting by an affirmative vote of a majority of all the members of the Association, and at any special meeting called for that purpose, the object having been stated in the call, upon the vote of two-thirds of the members present, the proposed amendment or amendments having been first signed by not less than 25 members, and filed with the Secretary at least thirty days before said meeeting, written notice of such proposed amendment or amendments having been mailed by the Secretary to each member of the Association, at least twenty days prior to such meeting.

The foregoing constitution was adopted at a meeting of the National Telephone Association, held in Harmonie Hall, Detroit, Mich., June 23, 1897.

Convention Notes.

MR. JOHN RICE, of Elkhart, Ind., represented the Cleveland carbons.

MR. E. REUBEL was at the convention to represent the St. Louis Electrical Supply Company.

MR. S. H. COUCH, of Whitman & Couch, Boston, was one of the few delegates from New England.

MR. H. E. PROCUNIER, of Chicago, was the urbane representative of the Moon Manufacturing Company.

MR. W. S. ECKERT, of the Bi-Metallic Transmission Company, New York, did some effective work for bi-metallic wire.

MR. F. S. VIELE, of the Pittsburg office of the Standard Underground Cable Company, represented his company at the convention.

MR B. F. STEWART very ably represented the Western Signal Company, of Chicago, and let no opportunity pass to extol the merits of its goods.

MR. J. G. IHMSEN, general manager of the Keystone Telephone Company, of Pittsburg, also represented the exchange at Three Rivers, Mich.

MR. R. J. CRAM, of the Farr Telephone & Construction Company, Chicago, made many friends and brought his goods to the notice of a large number of the delegates.

THE INDIANAPOLIS ELECTRIC COMPANY was ably represented by its president, Mr. John H. Murphy. This company manufactures a number of well-known electrical and telephone specialties.

MESSRS. J. M. NELSON and Wm. Hoyle represented the Hoyle & Scott Company, operating a telephone exchange at Cambridge, Ohio. They have already 175 stations, and are rapidly increasing the number.

MR. CHARLES E. PHELPS, JR., of Baltimore, represented the Delmarvia Telephone Company, of Wilmington, Del. Mr. Phelps is now engaged in constructing exchanges at Erie, Pa., and a number of other points.

MR. P. P. NUNGESSER, president of the Nungesser Electric Battery Company, Cleveland, Ohio, was at Detroit, in the interests of the fine line of open and closed circuit and dry batteries manufactured by his company.

JUDGE R. S. TAYLOR, of Fort Wayne, Ind., was a notable personage at the convention. His connection with the prosecution in the famous Berliner case made him particularly interesting to the telephone men present.

MR. W. C. STERLING and his son, W. C. Sterling, Jr., of Monroe, Mich., were much interested in the proceedings at Detroit. These gentlemen operate the exchange at Munroe in addition to doing a large business in poles.

MR. JOHN VALENTINE (better known as "Jack"), of the Valentine-Clark Company, Chicago, was at the convention as an interested spectator. He says that, despite the recent depression, his company keeps busy and reports the outlook as excellent.

MR. E. C. WILCOX, general manager of the Connecticut Telephone & Electric Company, of Meriden, Conn., made many friends for himself and his apparatus at the convention. His company is making a very fast switchboard on an entirely new principle.

MR. W. H. BUTLER, of Akron, Ohio, has exchanges in Ravenna and Kent, Ohio, 200 stations being connected in the two towns. He has 40 miles of toll line in Portage County, which connects his exchanges with over 150 miles of other lines and many exchanges.

MR. JOHN H. SCOFIELD, vice-president of the Phoenix Interior Telephone Company, New York, represented his company at the convention. This company has always maintained a strong position on the patent question, and Mr. Scofield did some very effective work on its behalf while in Detroit.

MR. H. D. CRITCHFIELD, of Mt. Vernon, Ohio, secretary of the temporary Executive Committee, created a very favorable impression upon the convention by his dignified, sensible and vigorous remarks during the debate upon the constitution. Mr. Critchfield is interested in exchanges in Ohio.

MR. "TOM" MARSHALL, of Keithsburg, Ill., known from one end of the country to the other as the champion wing shot of America, was present as a delegate. Mr. Marshall owns many exchanges in Illinois and neighboring States, and is one of the most aggresive and prominent independent telephone men in the country.

MR. L. P. SMITH, of Smith & Patterson, New York, exhibited a few superbly finished telephones of the Ericsson long-distance variety. A desk set in the main office of the Cadillac Hotel, connected with a room on another floor, attracted much attention, as did the beauty of the operators employed by Mr. Smith to exhibit his 'phones.

MR. PETER BLOW, of Knoxville, Tenn., represented fourteen exchanges in that State in which he is interested. Mr. Blow says that the independent exchanges in Tennessee own over 1000 miles of toll lines, covering the entire Eastern half of the State. The large cities of Memphis and Nashville are soon to be supplied with independent exchanges.

MR. DAN A. MOSSMAN, president of the Huntington (W. Va.) Mutual Telephone Company, and of many other telephone exchange companies in West Virginia, Kentucky and Ohio, took a prominent part in the convention. His companies operate about 700 stations, mostly in small exchanges, which are interconnected by over 100 miles of toll lines.

MR. L. A. CARR, of Durham, N. C., president of the Interstate Telephone Company, was the first mover in independent telephony in the Southern States. He has exchanges in Durham, Winston, Salem, Wilmington and Goldsboro, N. C.; Charlottesville, Gordonsville, Orange, Roanoke and Salem, Va.; and Frederick, Md., as well as many miles of toll line.

THE WILLIAMS & ABBOTT ELECTRIC CO., of Cleveland, had a fine exhibit of their magnetos, bells ,and other appliances in one of the parlors of the Russell House. A shocking reception, which showed the power of their generators, was accorded to many visitors. The genial president, Mr. Samuel D. Latty, and Electrical Engineer J. A. Williams, were kept busy showing their goods to admiring delegates.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, of Chicago, had a very handsome exhibit at the Cadillac Hotel, under the charge of Messrs. Henry Shafer and A. B. Cotton. They showed a complete small exchange in operation and a number of very ingenious and handsome specialties. Their police fire-alarm and railway telephone-call system attracted much deserved attention.

MR. CHARLES MARTIN, of Detroit, successor to Mr. W. R. Cole, who has been so long and well known as a manufacturer of electrical instruments, was an interested attendant at the convention. Mr. Martin, who is a son-in-law of Mr. Cole, and has the benefit of the latter's experience, advice and assistance, manufactures telephones and switchboards. He constructed the superb switchboard which was so much admired in the exchange of the Detroit Telephone Company.

MR. G. W. BEERS, of Fort Wayne, Ind., represented the fine and large independent exchange in that city. This exchange has 1300 stations in Fort Wayne, and is connected with 130 towns, of which sixty are provided with exchanges, in Indiana and Ohio. The installation in Indianapolis is of the most substantial character, the lines being in conduits in the central parts of the city. It is said of this exchange that it has more stations in proportion to the population than that in any other city in America.

THE KEYSTONE TELEPHONE COMPANY, of Pittsburg, Pa., made a fine showing of its goods in one of the parlors of the Cadillac Hotel. A variety of telephones and switchboards were shown, including both carbon ball and granular types of transmitters, wall and desk sets, intercommunicating instruments for factory use, and a beautiful hotel set for communication between the office and rooms of hotels. Messrs. J. G. Ihmsen, general manager, and Burt Hubbell, secretary and treasurer, made admirable representatives, and transacted no little business at the convention.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, of Chicago, had a fine exhibit under the supervision of President P. C. Burns, General Manager H. C. Dodge, and Mr. E. C. French. The beautiful finish of the telephone sets elicited much admiration. The exhibit included desk and wall sets, cabinets, the "new express" switchboard, upon which 100 drops are mounted in a space 17 inches square, and many other features of interest. During the few days of the convention two exchanges were contracted for by the enterprising gentlemen in charge of the exhibit.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY had a very fine exhibit of its manufactures, presided over by its president, Mr. James E. Keelyn, ably assisted by Messrs. C. P. Platt, J. A. Russell, Kempster B. Miller, J. T. Nolan, and S. S. Stout. The exhibit included a full line of telephones and switchboard appliances. Among other features may be mentioned the new transmitter, said to be a new departure, and the elaborate new switchboards. On these great improvements have been made, especially in the operating key. Some handsome cabinets, desk sets and wall 'phones were shown.

THE NATIONAL CARBON COMPANY, of Cleveland, was ably represented by Mr. Richard O'Connor. It showed a handsome exhibit of batteries and carbons. Especially noteworthy were their National cells, having removable carbon porous cups containing depolarizing materials. A large variety of single-cylinder and other open-circuit cells were shown, as well as some very large sal ammoniac cells and closed-circuit cells of the Fuller type. All these cells are provided with a new non-corrosive carbon terminal. The exhibit included a large number of telephone carbon specialties, such as diaphragms and granular carbon. It attracted much attention and favorable comment from delegates who visited it.

MR. S. D. LATTY, of the Kirk-Latty Company, Cleveland, Ohio, will not soon be forgotten by those who had the good luck to be invited to the now famous frog dinner. In addition to being secretary and general manager of the Kirk-Latty Company, and president of the Williams-Abbott Company, of Cleveland, he is a most genial host. The frog dinner was given at Chappell's, on the Canadian side of the Detroit River, about five miles below the city. Among the guests were Mr. F. M. Kirk, one of the leading spirits of the Kirk-Latty and Williams-Abbott Companies, and president of the former, as well as one of the largest mine owners in Ohio; Mr. J. A. Williams, generally known as "Little Joe" Williams, electrical engineer of the Williams-Abbott Company, and inventor of many of their specialties; Mr. "Kate" Claxton, of Chicago; Mr. P. C. Burns, president of the American Electric Telephone Company, Chicago; Mr. H. C. Dodge, of the same company; Mr. John H. Murphy, president of the Indianapolis Electric Company; and Messrs. Burt Hubbell and George Ihmsen, of the Keystone Telephone Company, Pittsburg. The guests were driven in carriages from the Cadillac Hotel to Chappell's. It was unanimously declared by those who enjoyed Mr. Latty's hospitality that he is a wizard.

DIGEST OF CURRENT TECHNICAL ELECTRICAL ARTICLES COMPILED FROM FOREIGN AND AMERICAN JOURNALS

BY

CARL HERING

DYNAMOS, MOTORS AND TRANSFORMERS.

Problem of the Small Air-Space Dynamo. ATKINSON. Lond. *Elec.*, June 11.—An article supplementary to the one by Mordey (see *Digest*, last week), discussing the point raised therein regarding a small air space; he praises the paper, but complains of the fact that the author in his papers keeps back facts and figures vital to the discussion, although the educational value of his work lies in the consequent prolonged discussion. When a coil reaches the brush energy is stored in it; this must be released and a corresponding amount in the opposite direction in space must be generated before it leaves the brush, if the commutation is to be sparkless; there are two methods; the stored energy may be converted into mechanical energy of rotation and this again into electromagnetic energy in the direction required; or the stored energy may be converted into heat, which must be supplied by the prime mover; the necessary condition of sparkless reversal is to thread twice as many lines of induction through the coil as are represented by the flux producing the voltage, plus a small amount representing the losses; one method is the ordinary commutation with the coil under the leading pole and a variable lead to compensate for variations; Mordey's method is an example of this; this can be effected only as long as there is a positive field due to the exciting coil under the leading pole; he shows that the use of chord windings will not allow of the great diminution in the air space required. He then discusses the split-up brush; he obtained good results, but like with carbon brushes the result is obtained at the expense of efficiency; that is, the dynamo is as inefficient as when sparking. In the discussion it was remarked that a small air space was inclined to produce an unequal pull on the armature, which may become very great; this, however, can be met in double-field machines (in single-field machines air spaces are out of the question); if in the double-field machines an air space is cut through the middle of the field parallel to the direction of the lines and to the shaft, the opening being five or ten times the length of the clearance space, the difficulty is overcome; in this case the increase in one coil is largely balanced by a decrease in the other, and if the sum of the induction times the ampere turns remains constant while the armature is in motion it will not tend to move toward one pole or the other; this he has verified experimentally. Summing up the question of small air-space dynamos he states that Ryan and Thompson's solution is perfect, but it has not established its commercial value; an approximately perfect solution is obtained by Sayers' winding, but this is only of value in large machines; the Mordey chord winding is an improvement on ordinary windings, but is best adapted to small machines.

Sparkless Collection. BROWN. Lond. *Elec.*, June 11.—A communication referring to some results which he has obtained. He refers to the discussion of Mordey's paper in which the objection was brought forward that the "winding must suffer from want of power of commutation through having only a portion of the whole section available for the purpose;" he shows that his objection is groundless. The machine had 44 sections with three complete turns of six conductors to each section; this was rewound so that there were only 22 sections with six turns and 12 conductors, two of which were placed forward, the distance between the forward conductors and the main part of the section being a little short of the distance between the horns; the results are given and show that the machine, when wound in the ordinary manner, reaches its maximum output at full load, but when covered with sections having only one-sixth of the conductors available for commutation it can stand an overload of 80 per cent. quite sparklessly; as the back turns are replaced by forward turns the horns are less and less weakened by any given ampere turns on the armature, allowing a given section carrying a given current to be successfully commutated with a smaller portion of its circuit than would be possible if it had to work in its usual position.

Armature Reaction and the Theory of Commutation. HAWKINS. Lond. *Elec.*, June 11.—The conclusion of his long serial; he discusses double-wound armatures, comparing them with those of single windings. No general summary or conclusions are given.

220-Volt Unipolar Machine. CHARRY. *L'Elec.*, June 5.—The first part of an illustrated description of his new unipolar machine, the illustrations including cross-sections and details. He shows that improvement is possible in dynamos in the reduction of the weight of copper and other materials; in the present machine this weight is only one-third, while the amount of copper on the armature is reduced to one-seventh; in a 40-kw machine the output was more than 56 watts per kg of total weight and more than 1300 watts per kg of copper as compared with 20 and 170, which are the means for the ordinary machines; the voltage may be made anything desired; there is claimed to be absolutely no hysteresis or self-induction in the armature. The field is made of a hollow iron ring containing a coil in the inside and it is therefore an iron-clad armature; there is a short air gap in this magnetic circuit in that part of the ring toward the axis and in this air gap revolves a disc armature; this disc is made of radial conductors which are connected in series with each other so that their E. M. Fs. are added by means of fixed conductors which connect the outer end of one with the inner end of the next. A 40-kw machine gave 185 amperes at 230 volts and at 1800 revolutions; the weight, including the base, is 710 kg, the weight of copper and magnets 25 kg; the armature is made of iron and only 5 kg of copper is used on it; 6100 ampere turns are necessary for excitation, involving an expenditure of 500 watts; a detailed description of the magnets is given; the induction is 16,000 gausses, producing 13,100 in the air gap, which is 4.5 mm in length; the length of the magnetic circuit is 62 cm. The description is concluded in the issue of June 12; he gives an illustrated description of the armature; this consists of a movable disc of copper divided into radial strips or sectors, insulated from each other, and of two similarly radially cut iron discs or rings which are secured to the polar surfaces; these fixed portions have a small contact brush at each end of each of the radial sections, the brushes touching the revolving disc; thus the current generated in each section of the moving disc is led through these fixed brushes from the outer end of one sector to the inner end of the next and so on, collecting them all in series; the conductors are insulated from each other by air spaces for the sake of ventilation; the conductors are not otherwise insulated; the reason for having fixed radial connections on both sides of the armature is said to be that the current is then not interrupted at any time; the two fixed discs are shifted with respect to each other by an angle equal to that of one of the sectors; there will be a time when the current in the movable conductors will be divided into two currents of half the intensity in each of the fixed connectors; it is claimed that there will therefore be no sparks due to self-induction (proof of this would be desirable); the use of such a large number of brushes, namely, four times as many as there are movable conductors, he claims is not as great an objection as might at first appear, as their construction is simple and cheap. The armature reaction is not only entirely avoided, but it may even be made to assist the field by a proper disposition of the parts.

Single-Phase Motors. BERG. *Amer. Elec.*, June.—He discusses the principles involved in self-starting single-phase motors. The alternating repulsion motor is stated to be the best of several types of commutator motors described; in this type the commutator is used only in starting, and the motor runs as a straight-induction motor. Single-phase alternating synchronous motors with the commutator used in starting are stated to be more objectionable than the first named, owing to the greater amount of sparking. A new type of single-phase induction motor is described, in which the starting device consists of a reactive coil in series with a non-inductive resistance connected across the mains; a wire taken from the junction between the resistance and the reactance is carried to one terminal of the induction motor, the other two being connected directly to the mains; on open circuit the current at the motor terminals and across the reactance and resistance has an E. M. F. in phase with the current in the resistance part, and an E. M. F. in quadrature in the reactance part; this arrangement establishes an out-of-phase E. M. F. similar to that of the monocyclic system, and thus the motor can start with a load.

LIGHTS AND LIGHTING.

Variations of Temperature in Incandescent Lamp Filaments. JANET. *L'Eclairage Elec.*, June 5.—A short article supplementary to that of Guye (see *Digest*, May 22, under Electrophysics). He made similar calculations and arrived at the same general results, but carried them further so as to get numerical values for the case of an incandescent lamp filament; he thus finds that the mean temperature of the filament is the same as that which would be produced by a constant voltage equal to the effective voltage; also that the variations of temperature with a 16-cp lamp filament when the frequency is 40 are about 10 degrees more or less than normal; if the light s proportional to the cube of the energy the light will vary between 14.1 and 18.5 candles, which variation will have double the frequency of the current.

Aron Arc Lamp with Cadmium Amalgam.—Elek. Anz., June 3.—A brief notice from a report of the Reichsanstalt, concerning experiments to replace mercury in the Aron lamp by cadmium amalgam. It was found that the lamp would not burn continuously on account of a layer of oxide on the

surface, but when amalgam was carefully filled into the tube so as to prevent oxidation, the lamp could be kept burning constantly; experiments were also tried with zinc, tin and potassium amalgam. (In this lamp, as was described before, the arc is formed in the top of an inverted U-shaped glass tube.)

220-Volt Lamps. Gibbings, Bradford, Eng. *Amer. Elec.*, June.—The great advantages of the 220-volt lamp are maintained; a long list of English stations using 220-volt lamps is given; in Great Britain the 110-volt system is now obsolete for any new schemes, while those which already exist are rapidly being changed over to 220 volts; even the alternating systems are being changed as far as the pressure of distribution on the low tension network is concerned; there is now no difficulty in obtaining good 220-volt lamps; ordinary first-class wiring for 110 volts is found equally satisfactory for 220 volts; the chief alteration required in fittings consists in greater breaking distance between the contacts or switches used for controlling one or two lights, which distance should not be less than three-eighth inch; fuse fittings will require the length of fuse to be increased to at least one inch gap for the smaller sizes, and for perfect security it is desirable to adopt a design which has a bridge of insulating material between the terminals. An arc lamp is described of the author's design which has two independent pairs of carbons; it has been found to give good service on 220-volt circuits.

POWER.

Local Distribution in Workshops. Scott. Lond. *Elec. Eng.*, June 11.—A continuation of his long serial. He gives curves showing the relative speeds, prices and weights of single-phase, polyphase and continuous-current motors; he calls attention to the question of speed, showing that for adaptibility to required speeds the continuous-current motor is by far the most convenient; the prices of certain single-phase machines varies about 28 per cent. higher than the same makers two or three-phase motors, the latter corresponding almost to that of continuous-current machines.

The Economics of Power Transmission. Bell. *Amer. Elec.*, June.—He discusses the calculation of the cost of a power transmission scheme. A preliminary investigation should be conducted to determine as accurately as possible the amount of electrical energy that can be sold and its distribution. A case is thus calculated for a city of 25,000 inhabitants, the source of water power being 15 miles distant. After estimating the probable consumption of electrical energy, the hydraulic development is taken up; under ordinary circumstances $75 per effective horse-power should easily cover the total cost up to the wheels; for 2000 horse-power $25,000 should put the wheels in place ready to run with all accessories; $7,500 should erect a station, $2,500 furnish a building for the station men and stores, and the cost of generators, transformers and accessories would be, ready to run, $50,000. A voltage of 10,000 is assumed, and for computing the cost of the line the following simple formula is given:

$$P = \frac{r D^2 \frac{W}{V}}{v}$$

in which P is the total cost of the bare-line copper in dollars; r, the price of bare copper per pound in *cents*; D^2, the square of the distance of transmission in thousand feet; W, the total watts delivered; V, the voltage at receiving end, and v, the volts lost in the line. This formula is given as accurate to within a small fraction of 1 per cent. The cost of the line is thus found to be $15,000, or $25,000 with the poles and insulators. The line is stated to be usually a rather small item, often not more than 10 per cent. of the cost of the plant, and rarely over 25 per cent. The article concludes with an estimate of the operating expenses and an analysis of the several different factors entering into the estimate of cost of plant.

The Failure of Fuel Gas.—Prog. Age, June 15.—In a paper by Shelton, read at the recent meeting of the Western Gas Association, which is reprinted in full in this journal, he calls attention to the failure of commercial attempts to supply fuel gas in the United States; in the past 16 years 27 trials were made, and of these 22 have utterly collapsed, and of the other five, two are trying to get out of the business, while the other three, after six years' operation, show a less output and fewer customers, without returning a dollar of earnings to the stockholders; detailed information is given quite fully in the paper.

TRACTION.

Electric Railways and Electromagnetic Induction.—Lond. *Elec.*, June 11.—A reprint of some of the diagrams obtained by Ayrton in 1893 in the neighborhood of the City & South London Railway, the measurements being taken with a magnetometer; these are the results which he referred to in his recent discussion of the Trotter paper; no general conclusions are given, except an indication that the disturbances are in a measure due to the earth return currents.

Accumulator Traction.—Elektrochem. Zeit., June.—A notice from a recent report concerning the Hanover line (where the cars are run partly with an overhead line and partly with accumulators) stating that during snow storms in winter the cars could be kept running only because they carried accumulators, as the overhead line was disabled by the ice.

Accumulator Traction in Paris.—L'Energie Elec., May 16.—A long article, accompanied by a large number of illustrations, giving a detailed description of the new line, which was described in the *Digest*, May 22; many of the illustrations are the same as those in the former article.

Electric Railways in Austria.—Zeit. fuer Elek., June 1.—A table of statistics showing the operation for the first quarter in 1897.

Brussels. Dieudonne. *L'Eclairage Elec.*, June 5.—An illustrated description of the trolley line in that city.

Motor Carriages.—Lond. *Elec. Rev.*, June 11.—A brief account of the "fiasco" of the recent competitive tests of the London *Engineer*; brief descriptions of some of the carriages are given.

Repair of Electric Railway Apparatus.—Amer. Elec., June.—Directions for the manual operations in banding the armatures of electric railway apparatus.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Application of Accumulators as Equalizers. Illner. *Zeit. fuer Elek.*, June 1.—A reprint of a lecture in which he discusses the application of accumulators for equalizing the variations in the voltages due to various causes and for equalizing the output of a machine when the consumption is variable; each case is discussed separately, and methods are given for properly proportioning the plant; he shows that it is not the accumulators alone which must be proportioned to meet the requirements, but that both the dynamo and accumulators as a combination must be considered and that the success of a plant depends on the proper proportioning of both these combined. Briefly, the process consists in properly combining the characteristic curves of the accumulators and of the dynamos; the curves for accumulators, as obtained by rapidly alternating partial charges and discharges, are given; the current was reversed, but kept constant, every five seconds; this shows that the difference in voltage at charging is in general larger than at discharging, and these differences are very great toward the end of the charge, while during nearly the whole discharge they are the same; they are due to the internal resistance and directly proportional to the current density; the discharge voltage is nearer to the normal than the charging voltage, in the ratio of about 3 to 4; curves based on these data are used in his further deductions. He assumes the characteristic of a shunt machine and shows how the accumulators must be proportioned; he finds that the capability of regulating for the same battery is better when the characteristic of the machine falls less abruptly, that is, the smaller the armature reaction, when the changes in voltage are due to changes in the current; when they are due to changes in speed, the accumulator is the only means for compensation, and then the larger the armature reaction the smaller may be the accumulator; these conditions are, therefore, opposed to each other and a mean must be taken depending on which variation is the more important. For equalizing the current, as for railway work, he shows that the dynamo should deliver a constant number of watts, but it would be impossible to construct such a dynamo and its curves should therefore be tangent to the required one; when compound machines are used accumulators will increase, instead of diminishing, the variations in the current, and the series winding should, therefore, be disconnected. It is a mistaken idea to imagine that an accumulator will equalize currents without a careful proportioning of both it and the dynamo. When variations in the line wire are to be compensated, the accumulator should be put at the distant end of the line or at the principal place of consumption, in which case the feeder may be reduced to one-third in its size; on large electric locomotives the accumulator has best be placed on the locomotive itself.

Brussels. Travailleur. *L'Eclairage Elec.*, June 5.—A long illustrated description of the electric lighting station, to which about 40,000 lamps were attached; it is a continuous current plant on the three-wire system with which a large battery of accumulators is connected; there are also two secondary stations with gas engines and accumulators.

Cologne.—Elek. Zeit., June 3.—A long abstract, with numerous tables, of the report showing the operation of this station up to April, 1896.

Lightning Arrester. Findeisen. *Elek. Zeit.*, June 3.—A short communication giving an illustrated description of an improved device. The line is connected to earth through four air gaps terminating in saw-teeth points as usual; the earth side of each one of these is connected metallically to earth through a fuse wire holding back a spring, which when released short circuits that particular air gap; if therefore the lightning has passed through the first one it, or the subsequent dynamo current, will have fused the wire, which short circuits that gap, and the next discharge will then find a free path to the second one whether the teeth of the first be fused altogether or not.

Best Means of Preventing Leakage. Walker. Lond. *Elec. Eng.*, June 11.—The beginning of an article discussing in a general way the subject of earth, earth currents, etc., in electrical installations and the best means of preventing such currents from generating heat and setting fire to buildings; the present portion is elementary and appears to contain nothing new.

Elizabeth. Roller. *Amer. Elec.*, June.—A well-illustrated description of the new station at Elizabeth, N. J., employing the monocyclic system. Besides the city of Elizabeth, including Elizabethport, service is given to five towns, the centre of the distribution of the most distant being 7 1-2 miles from the station. The distribution of the load at present is such

that the station location falls almost exactly central to the output. Wherever possible, distribution is made from central transformers on the three-wire system, the advantage of which system with alternating currents is that both sides do not need to be kept in perfect balance, any ordinary unbalancing being equalized by the transformers themselves. The teazer wire of the monocyclic machines is run only to districts where motors are installed.

Brighton, England. BATHURST. *Amer. Elec.*, June.—A well-illustrated description of the municipal lighting plant, of which Mr. Arthur Wright is engineer. The equivalent load at present is 35,000 16-cp lamps; the main distribution is on the three-wire low-tension system (115 volts), but in order to open up outlying residential districts the alternating system is employed; when a paying load has been obtained it is changed over to the main system. All cables are armored and placed direct in a trench, a line of bricks being laid above them to indicate their presence to those excavating afterwards. The size of the station has very largely increased during the past several years, largely on account of the system of charges instituted by Wright, which system is described in his paper read before the Niagara Convention.

Rouen, France. LAFFARGUE. *Amer. Elec.*, June.—An illustrated description; the total number of lamps supplied is 35,000 and the selling price of the kw-hour was about 12 cents in 1896; the central quarter is supplied by the three-wire continuous current system; for the outlying quarters the alternating current is employed in connection with sub-stations having a rotary transformer, which also charges a storage battery; the central station also has a storage battery; the alternating current voltage is regulated by cutting in or out a certain number of primary returns of the station transformers.

Alternating vs. Direct-Current Central Stations.—Amer. Elec., June.—An examination of the various claims put forth for the two systems. The conclusion is that a comparison is unfair, for the reason that with the continuous current great attention is given to secure good regulation by manual and not automatic means, while the alternating-current station is expected to regulate for itself, which it does to a certain extent, even better than would a direct-current system under similar circumstances. On equal grounds it is concluded finally that the alternating-current system may be made to excel the direct system in first cost, while in the operation of its machines and in regulation there is no reason why it should not equal and even surpass it.

WIRES, WIRING AND CONDUITS.

Advantages of Insulated Pipe. BATHURST. Lond. *Elec. Rev.*, June 11.—A reply to the recent articles of Zingler (see *Digest*, May 22, 29, and June 5); he answers the criticisms against insulated pipes, referring largely to the recent discussion in THE ELECTRICAL WORLD, from which he quotes; no new points appear to be made; he admits that the lining is a first cost investment, but it should be considered with reference to the depreciation; to use plain pipe would encourage even plumbers and gasfitters to enter the electrical business; Zingler's table of costs should have been based on present prices; the extra cost of the insulation is but a small portion of the total cost of an installation.

Test Wires in Feeder Cables. KALLMANN. Lond. *Elec.*, June 11.—A communication calling attention to the great advantage of using feeder cables containing pilot wires or test wires, as these will be found of great use in a number of ways.

Overhead Lines. MONTPELLIER. *L'Elec.*, June 5.—The first part of an article describing the construction of overhead lines; in the present portion he discusses poles, showing how the dimensions should be chosen and how they are preserved.

Rules and Regulations for High Voltage Installations.—Elek. Zeit., June 3.—A reprint in full of the recommendations adopted unanimously by a committee of the Union of German Electrical Engineers, which are to be presented for adoption at the next annual meeting; it refers to voltages above 1000 and does not include electric railways.

Insulation Material. MARZAHN. *Elec. Tech.*, May 31.—The beginning of a reprint of an article on insulation materials, manufacture of insulated wires, etc.

Line Effects in Alternating-Current Transmission. RAYMOND. *Amer. Elec.*, June.—Where a high tension alternating current line passes underneath trees the best rubber insulation is considered necessary, together with a strong covering to prevent mechanical injury; it would probably be cheaper to make a considerable detour rather than to install the wires as above described; he has seen twigs drop across heavily W. P. insulated wires with but 2500 volts across them and start an arc that at once burned the wires off, the distance apart between being 10 inches; with bare wires when the weather is damp or the trees are wet, the contact of branches will in a short time either burn out the line or the tree, and it is generally the former.

Drop in Alternating-Current Lines. MERSHON. *Amer. Elec.*, June.—A table and chart, accompanied by examples, by means of which the drop in an alternating-current line can be very simply determined, the resistance, power-factor and inductions all entering in the result. The arrangements of conductors for minimum inductance are given for two and three-phase currents; an arrangement is described whereby the voltage at the receiving end of an alternating-current line may be indicated in the station, account being taken of current, power-factor, reactance and resistance. The method described is stated to have proven perfectly satisfactory in practice.

Calculation of Weight of Copper Wire. NORTON. *Amer. Elec.*, June.—The circular mils of each of the several different wires where combined weight is desired to be known, are multiplied by the length, and the sum divided by the circular mils of some wire whose weight per foot is known; the equivalent in length of the latter wire is thus obtained, which, multiplied by the weight per foot, will give the combined weight of the several wires considered.

Calculation of Special Forms of Incandescent Lighting Circuits.—Amer. Elec., June.—Numerical examples are calculated for a graduated incandescent circuit, a graduated anti-parallel circuit and an equalized feeder circuit. Of the several cases calculated, it is shown that the last-named circuit is the most economical for the specific case considered.

Interior Wiring.—Amer. Elec., June.—Instructions on the details of cleat and knob wiring, in methods of passing through walls and beams, manner of making joints, etc.

ELECTRO-PHYSICS AND MAGNETISM.

Capacity and Residual Charge of Dielectrics. HOPKINSON and WILSON. Lond. *Elec. Rev.*, June 11.—A continuation of the reprint of their Royal Society paper; a brief abstract appears in the Lond. *Elec.*, June 11. They investigated the effects of variations of temperature and time on the residual charges and capacity and found some interesting connections between a perfect insulator like glass and an electrolyte like ice pointing toward a unification of the ideas of conduction in general.

Lorentz Theory and the Experiments of Zeeman. POINCARE. *L'Eclairage Elec.*, June 5.—A mathematical article explaining the Lorentz theory in connection with Zeeman's experiments; this theory of hypothesis is that electric charges are carried by material molecules from which they are inseparable; each charge is constant and its distribution invariable; all changes in the field are due to displacements of the molecules carrying the charges with them; a current is due to a movement of these charged particles; in dielectrics they can only be displaced slightly.

Physics. POINCARE. *Rev. Gén. des Sciences*, May 30.—A long article in the form of an annual review of progress in physics, large portions of which involve the branch of electricity.

Action of Fluorescent Substances on Cathode Rays. TURNBULL. Lond. *Elec.*, June 11.—A brief communication calling attention to the fact that under certain conditions the approach of a fluorescent screen close to the tube produces a stoppage of the discharge in the tube, the conditions being that the vacuum is high and that there is a multiple circuit of slightly higher resistance than that of the tube through which the discharge may pass when it does not pass through the tube; the effect of the action is apparently to increase the internal resistance of the tube. He also shows that when the vacuum is so high that discharge ceases, the discharge will be re-established by bringing the hand close to the tube.

Swinton's Cathode Ray Experiments. SWINTON. Lond. *Elec.*, June 11.—A note stating that FitzGerald's interesting suggestions (see *Digest*, June 19) do not apply as an explanation to some similar observations.

Magnetism and Concussion. FROMME. Lond. *Elec.*, June 11; noticed briefly from the *Wied. Ann.*, 61, p. 55.—A systematic study of the effects of shocks on the magnetization of iron; most of the experiments were made in a field of zero intensity; the results are said to be definite and suggestive. The effects of concussion are independent of simultaneous bending or torsion and also of the previous magnetic history of the specimen; they affect the molecular magnets directly, probably leading to a different grouping; when the magnetizing force is small a specimen subjected to shocks shows a reduced susceptibility and permanent magnetization.

Terrestrial Magnetism. DE ROCHAS. *Cosmos*, June 5.—A brief description of Lagrange's observations in Brussels; he found that there were systematic variations which were not the effect of a magnetic force, and he attributes them to some new force; he (ROCHAS) thinks the cause attributable to the circulation of ether.

ELECTRO-CHEMISTRY AND BATTERIES.

New Process of Producing Aluminum. KERSHAW. Lond. *Elec.*, June 11.—A brief description of the Blackmore process, which was recently described by the inventor at the Society of Chemical Industry in New York. It is a new method for producing aluminum sulphide on an industrial scale; this compound is easily reduced to aluminum and sulphur; the substitution of the sulphide for the oxide reduces the voltage from 5 to 3 1; the cost of producing the aluminum sulphide is only 6 cents per pound. Kershaw points out that the cost of the electric power is not always the sole or even the prime factor to be taken into account in estimating the chances of success; the cost of wear and tear on the plant it is thought will be rather high for this process.

Carbons for Electrolytic Purposes. KRUPKA and JACOBY. Lond. *Elec.*, June 11.—A note stating that the recent test of Lessings' carbons, (see *Digest*, June 12), is of no importance for showing their practical value; the tests are no criterion as to the value of these carbons for the electrolysis of salt, for which they are used mostly; he states that there is not a single

factory in the most important countries in Europe in which these carbons are not being used or being tried.

Electrolytic Preparation of Oxyhydrates and Metallic Sulphides.—L'Elec., June 5.—A brief description of the Lorenz process which is spoken of very highly. He uses as an anode the metal whose compound is required, the cathode being made of platinum, on which the product will be deposited; the precipitates are suspended in a neutral liquid, which is very important, as this cannot be accomplished by manufacturing them by the usual chemical process. The protoxides of various metals can also be formed; he has in this way prepared the hydrates and protoxides of copper, lead, zinc, cadmium, iron, magnesia and aluminum. In an analogous method he prepares the metallic sulphides.

Alkalies and Bleach.—Elektrochem. Zeit., June.—A brief illustrated description of the Kellner process.

Electrolytic Production of Metallic Wares.—Elec. Tech., May 31.—A brief description of the patented process of Nussbaum, who strips the mould from the electrically deposited metal by means of water under pressure forced between the two.

Electrolysis of Water at Low Voltages. Tommasi. *Elektrochem. Zeit.*, June.—An abstract from a French journal. For decomposing a "molecule" of water requires exactly 69 calories, corresponding to 1.47 volts; it can also be decomposed by currents of much lower voltages; he explains this apparent inconsistency by means of the phenomena of dissociation; composite bodies can be decomposed at a much lower temperature than that produced at the union of their elements, the process ceasing when a certain dissociation tension has been reached; there remain molecules of hydrogen and oxygen which are not combined; this explains the apparent inconsistency; there is really no true decomposition at lower voltages, but it is only a freeing of the dissociated molecules; this first process he calls "electropseudolyse."

Theory of Ions. Crompton. Lond. *Elec. Eng.*, June 11.—A very brief abstract of two papers on the theory of electrolysis, read before the Chemical Society.

Theory of Electrolysis. Bucherer. *Elektrochem. Zeit.*, June.—A brief reply to Nernst's recent criticism of his theory.

Instruction in Electro-Chemistry. Haller. *L'Eclairage Elec.*, June 5.—Long extracts from two recent articles; they consist largely of brief descriptions of the various processes in commercial use; he calls attention to the important work in this direction in Germany: the object of the article appears to be to encourage a similar development in France.

Oxidation of Carbon without Heat. Case. *Amer. Elec.*, June.—A reply to the article by Reed (see *Digest*, May 1), in which the claim made by Case of having oxidized carbon without heat was contested. Case has proved that carbon can be oxidized below its igniting temperature without the continuous application of heat or electrical energy; and that researches capable of verification have been published indicating or proving that carbon has been oxidized at low temperatures in other than the two ways mentioned in Reed's article; oxidation of carbon may also take place at normal temperatures when it is combined with other substances.

Thermo-Electric Batteries. Anthony. *Amer. Elec.*, June.—A reply to Reed (see *Digest*, May 1), in which the Jacques cell is criticised. The writer holds that the operation of the Jacques cell does not require the continuous application of heat, but only that the cell be placed where the temperature is sufficiently high. In the thermo-electric element, heat energy is directly converted into electric energy; this is not the case in the Jacques cell, in which carbon is the material consumed.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Potentiometer. Franke. *Elek. Zeit.*, June 3.—An illustrated description of what he calls a compensator, which he devised for the purpose of calibrating volt and ammeters by means of a simple transportable apparatus which is very easily applied; he also calls attention to the importance of calibrating station instruments frequently. It consists of a resistance wire in series with which there are 15 successive resistance coils which are inserted by a sliding contact; the battery is a two-volt accumulator and is in series with an adjustable resistance which can be varied within very narrow limits, but which does not need to be calibrated; the rest of the connections are like in the ordinary potentiometer. The voltmeter to be calibrated is exchanged by means of a switch in place of the standard cell, that is, in series with the galvanometer, one terminal of which is the sliding contact; when a Weston cell is used of $\frac{1}{1.02}$ volts the switch is set to include 10 of the resistances, and the sliding contact is set at 2, the resistance in series with the accumulator being then varied until there is no deflection of the galvanometer; the readings on the potentiometer wire with the coils in series will then be directly in volts; the voltmeter is then easily calibrated from this scale; (this supposes no deflection in the galvanometer, and as it is in series with the voltmeter there would be no deflection in the latter; presumably, therefore, the voltmeter must be supplied with some external current in order to deflect it). To measure smaller voltages down to 0.001, a shunt is connected across the whole potentiometer wire, including the coils, and another resistance is inserted in the accumulator circuit; these are arranged to be inserted by withdrawing plugs; by properly proportioning these resistances the readings on the wire may be reduced to one-tenth or one-hundredth after the adjustment with a standard cell has been made. To measure larger voltages an additional set of coils of 1, 9, 90, 900, etc., is used and is connected to the higher voltage; the current for the potentiometer is then branched off from any desirable fraction of this resistance; (an error arises due to the current taken by the subscriber). The method assumes that the voltage of the accumulator does not change during a test; the construction of the apparatus is described in detail; currents are measured by the voltage at the ends of a known resistance, and resistances are measured by the volts and amperes. The price of the whole apparatus is not more than that of a Weston instrument.

Direct Reading Potentiometer.—Lond. *Elec. Rev.*, June 11.—A long illustrated description of an improved and convenient form made by Elliott Bros.; the potentiometer wire is divided into a large number of step-by-step resistances, only a small straight portion at the end being used for the sliding contact and this portion is carefully calibrated.

Magnetization of Needles for Static Galvanometers. Pretty. Lond. *Elec.*, June 11.—After briefly discussing the usual method and showing that the tendency is to demagnetize one set while the other is being magnetized, he describes a simple way of overcoming every difficulty. The whole suspended system with its two sets of needles is placed between two blocks of wood with recesses to receive it and which hold it securely like a mould; this is then placed, with the needles vertical, over the two poles of a U-shaped electromagnet on which are first placed two blocks of iron which can be moved laterally; over the block of wood is placed a block of iron; the magnetic circuit of the electromagnet is then completed through two air gaps occupied by the two sets of needles, the lines being in opposite directions through the two sets; the current should be broken before the needles are placed into position or are removed.

Electrical Testing for Telegraph Engineers. Young. Lond. *Elec.*, June 11.—A continuation of his serial; he describes and discusses the four methods of measuring the dielectric resistance.

Mechanical Equivalent of Heat.—Lond. *Elec. Eng.*, June 11.—A brief account of the experiments made by Moorby and Reynolds, extending over a period of about two years. After introducing correction factors the mean corrected value was 776.94 at Manchester; this gives the practical and easily remembered figure of 777 in place of the usual 772.

Interference Galvanometer. Wadsworth. *Phys. Rev.*, May-June; abstracted briefly in the Lond. *Elec.*, June 11.—A long article in which he outlines a form of galvanometer with which he believes it will be possible to measure currents down to nearly a trillionth of an ampere; the instrument is not yet completed, but experiments have been made with the essential parts. It is based on the interferometer; light is reflected by a series of mirrors, so that part is reflected from a small mirror at one end of the galvanometer needle and part from a mirror at the other, both of the beams being reflected back into the same telescope; these two beams will produce interference fringes and the slightest motion of the needle will be indicated by a shifting of these fringes; a displacement amounting to the length of a light wave is easily observed; the instrument is to be mounted on very massive supports and floats on mercury.

Faults in Measuring Instruments.—Amer. Elec., June.—Directions are given for the calibration of voltmeters. The construction of a small and simple type of storage battery is given for obtaining a steady source of current and voltage; it consists merely of small pieces of U-shaped pieces of lead, dipping into small bottles; a sufficient number of such elements are used to secure the desired voltage.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Signalling Through Space Without Wires. Preece. Lond. *Elec. Rev.*, June 11, in full with illustrations; Lond. *Elec. Eng.*, in full without illustrations; Lond. *Elec.*, June 11, a full abstract with most of the illustrations.—A reprint of his recent Royal Institution discourse; an abstract under "Marconi Telegraphy" was published in The Electrical World last week, p. 822, giving the principal data concerning that portion referring to Marconi's system. He discusses briefly his own systems of induction telegraphy, describing it with the aid of a diagram and giving briefly the results; he thus refers briefly to the Evershed and Vignoles system; this is followed by an illustrated description of the Marconi system; this portion is reprinted in abstract in another column.

Working of the Cable from Germany to Norway. Petersen. Lond. *Elec.*, June 11.—A translation in abstract with the diagram of the article noticed in the *Digest*, May 29; see also April 10.

Rapid Cable Laying. Snell. Lond. *Elec. Rev.*, June 11.—A continuation of the discussion of his system.

Telephone Lines.—Amer. Elec., June.—Sources of inductive trouble on telephone lines are considered, and methods given for obviating them. Where a grounded line passes near a disturbing source, such as an alternating-current wire not too distant from the telephone which it serves, it is recommended to run a metallic return back from the telephone and ground it at a point beyond the disturbing source, the main line wire and this auxiliary wire being transposed at intervals.

MISCELLANEOUS.

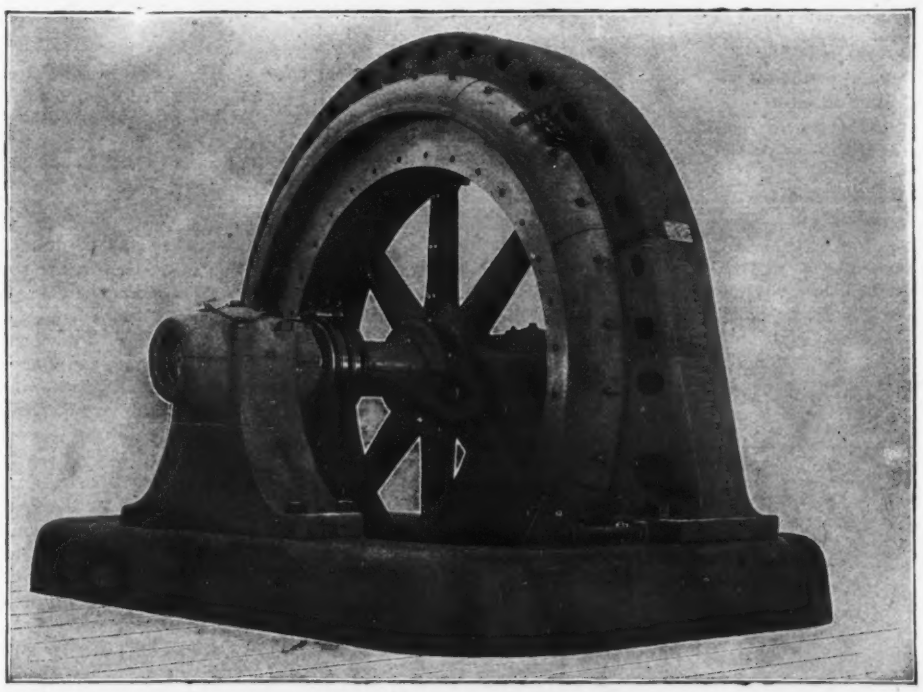
Electric Heating.—Elec. Tech., May 31.—A reprint of a short article by Hennings on the construction of the tunnel for the Jungfrau Mountain Railway in the Alps. He states that as the temperature of these regions never exceeds zero all the water used in the construction of the tunnel will have to be taken there in the form of ice, which will be melted by means of the electric current; electricity will also be used for heating, cooking and lighting in the apartments used by the workmen at the beginnings of the tunnels; a reserve locomotive operated by petroleum will always be ready; the tunnel will be bored by means of electrically operated drills; hydraulic machinery cannot be used on account of the low temperature.

Lightning. SIEMSEN. *Elek. Zeit.*, June 3.—A short illustrated article calling attention to two cases of chimneys struck by lightning, neither of which had lightning rods; one was 200 feet high, and it appears that the mortar in its construction had not yet become dry; the upper half was completely destroyed, some parts having been projected to a distance of 1000 feet, due, it is supposed, to expansion of the heated vapor; in the second case, the side of the chimney was wet owing to the rain; the lightning followed this to where an electric wire was fastened by an insulator, thence through the line, breaking the insulator and setting fire to the house entered by the wire.

Kataphoresis in Medicine. MEWES. *Elektrochem. Zeit.*, June.—A long article supplementary to a recent book by Oker-Blom on a physical-chemical basis of electromedical treatment, with special reference to iodine salts; the book is highly praised and is said to be a scientific work, showing that kataphoresis rests on a sound scientific basis; Mewes discusses kataphoresis and its application in the introduction of medicines into the human body; he defines kataphoresis as a mechanical propagation of particles of liquid in the direction from the anode to the cathode during the process of electrolysis; he gives the conclusions of Oker-Blom for iodine salts.

Revolving-Field Alternator.

The development of the revolving-field type of alternating-current generator and the standardization of a complete line, both for the monocyclic and three-phase system has, of late, occupied the attention of the engineering department of the General Electric Company with successful results. The alternators are designed for the standard frequency of 60 cycles and for pressures ranging between 500 and 5000 volts.



REVOLVING-FIELD ALTERNATOR.

The machines are built on the same lines as the General Electric type of induction motor. The stationary armature is built up of laminations stamped from specially selected and tested steel plates. Ample spaces are left for ventilation and the coils are covered and protected by shields. The base of the armature is of smooth cast-iron and the pedestals supporting the bearings are provided with spherical seats which support the boxes and allow of perfect alignment.

The revolving field is extremely simple in construction. It is merely an iron spider mounted on a shaft carrying a soft steel ring serving as a yoke for the pole pieces, which are made of laminated iron with polar projections. The field coils are removable and in the larger sizes are wound with flat copper strips placed edgewise, to allow of free egress from the coils of any heat. The armature can be moved along the base to facilitate access to fields and armature winding.

With a high efficiency these alternators combine good inherent regulation and can be, if desired, compounded for accurate automatic regulation. Such compounding in certain cases is not necessary to convenient operation, and may be omitted. When compounded a commutator is mounted on the shaft and rectifies current supplied from a series transformer in the main circuit. These compounding devices are not, however, included in the generator, properly so called. They come under the head of extras. The temperature of the armature and the field windings does not rise more than 45° C. above that of the surrounding atmosphere.

The new type of generator is not, of course, intended to displace the revolving-armature type. The revolving field type has its own special line of usefulness. It is free from high potential collector rings and commutators, the only collector rings being the two used to bring the exciting current to the revolving fields. The high potential part of the alternator—the armature—being a stationary structure, can be wound and insulated for much higher pressures than is desirable for revolving armatures, and the current can be fed directly into the line without the intermediary of step-up transformers. All the high potential terminals are effectually insulated.

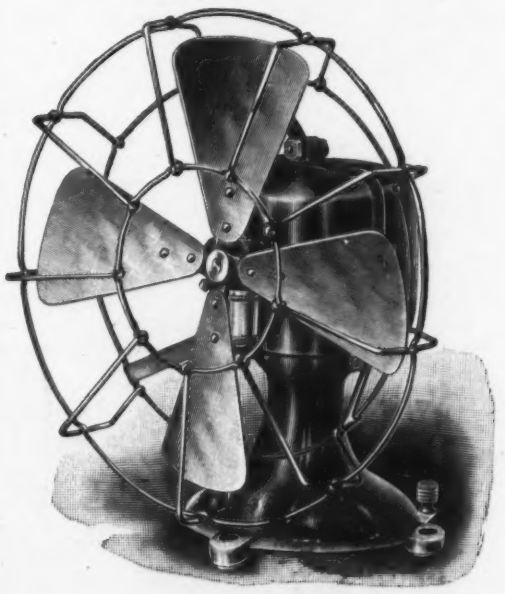
The revolving-field alternators can be wound for two-phase system when desired, and when so wound are so arranged that armature coils can be cut in or out to give independent regulation of the two phase.

During the past year the General Electric Company has built a number of machines of this type, some for belt drive, but principally for direct connection to water wheels and steam engines. The illustration shows a 750-kw, 40-pole three-phase machine, running at 174 revolutions and delivering current at 4400 volts. It is one of the twelve which will be used on the great Lachine Rapids installation.

A New Propeller Fan.

Among the many propeller fans brought out this year there is not one more worthy of special mention than that manufactured by the Diehl Manufacturing Company, Elizabethport, N. J.

The motor, which is of the iron-clad type, has the field magnets cast in one piece, forming an unbroken magnetic circuit, which contributes very materially to the efficiency of the machine. An iron cover plate screwed to the back of the field gives an easy access to the interior. The armature is of the drum form, built up of iron laminations, and runs in bronze self-aligning bearings which are provided with self-feeding wick oil cups. Silk-covered wire is used throughout, and great care is exercised to secure a very high insulation. The carbon brushes are held in simple brush holders, and are completely out of the way of injury. None of the parts are exposed, although ample opportunity is given to examine the interior through small apertures at both ends of the armature. A special Carpenter enamel rheostat having three speeds is carefully mounted in the base. Great attention has been given to the selection of the very best material, and every part is fitted to gauge. The fans, guards and oil cups may be had in nickel, polished brass or japan finish, while the remaining exposed portions are handsomely enameled and decorated.

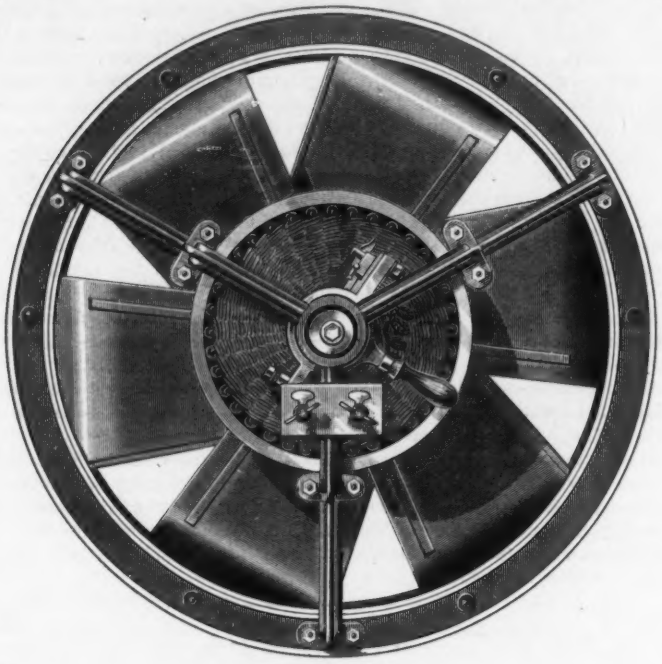


FAN MOTOR.

The motors are wound for either 220 volts or 110 volts direct current, and can also be furnished wound for lower voltages for use in connection with primary and storage batteries. The claim of highest efficiency made

by the company has been amply substantiated by a series of tests recently made on 100 fans run from a 115-volt circuit, which, at a speed of 1800 revolutions per minute, consumed on an average .35 amperes each.

The Diehl Manufacturing Company has also been very successful in the application of its standard slow-speed motors to exhaust fans, which are



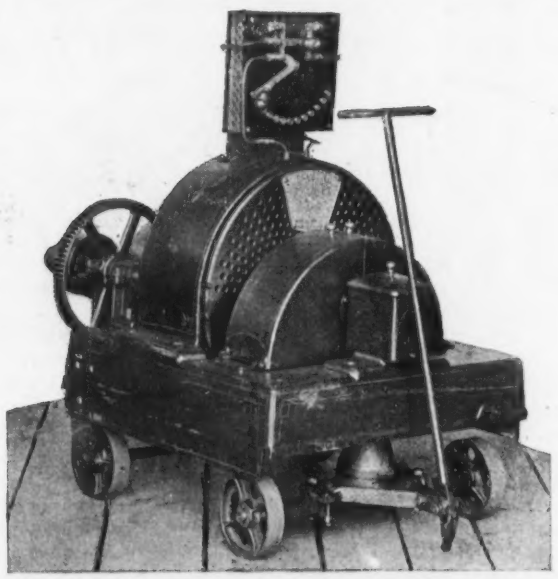
Exhaust Fan.

specially adapted for this service. The illustration shows a motor driving a Blackman fan, although any other style may be furnished if desired. As is well known, in this type of motor the armature, which is of the ring form securely housed by a brass ring, completely encircles and revolves about the field magnets. Besides giving a very high efficiency, a slower speed is obtained due to the larger size of the armature, together with a proportionately increased starting torque.

In addition to preventing injury, the brass ring serves as a balance wheel and affords a very large radiating surface, which enables the motor to stand a heavy overload. The motor and fan blades are fitted to the same shaft, using one set of bearings and requiring minimum power for driving. These fans have found universal use in ventilating hospitals, factories, dye houses, restaurants, mine shafts, etc.

Portable Motor.

In large machine shops, structural iron works and other places where drilling or light boring has to be done on heavy material much time can be saved by the use of a motor suitably mounted for easy transfer from place



Portable Electric Motor.

to place. The frequent calls for such a tool have caused the Card Electric Company, Mansfield, Ohio, to bring out the mounted motor illustrated herewith. All the working parts of the motor are enclosed as a protection against accidents, from dirt or the careless handling of a material around the machine. The cone pulley shaft is driven from the armature shaft by gearing and the ratio of the gears is such that the cone pulley is made to run as near 200 r. p. m. as possible. On the armature shaft is a small pulley which can be used for driving high speed machinery direct. The starting rheostat is non-combustible and has a double pole switch mounted on it, and as all the connections to the motor are made before shipment from the factory nothing has to be done to put the motor in operation but connect the line wires to it. These mounted motors are manufactured by the Card Company in sizes from 2 to 12 horse-power, inclusive, and purchasers are furnished a list of gears from which they can select a pair to give the cone pulley a speed suitable for their requirements.

System of Rapid Telegraphy.

Rapid telegraphy seems to be attracting unusual attention at this time and that the objects to be attained are worthy of the efforts being put forth is evident from the fact that some of the best minds are giving this subject very deep consideration. The system described below differs from most all others so far developed in that it delivers the message in Roman characters instead of symbols.

The preparation of a message consists merely in writing it on a typewriter which has a simple electrical punch attached, the message being registered by a combination of holes in a paper strip. This paper strip can be torn off as often as convenient or desirable and fed into the sending machine, whence the message is transmitted automatically to the receiving machine at the rate of 200 words per minute or over and delivered printed in Roman characters in page form. It will be observed that no more skillful labor is required than that of a typewriter, as the sending and receiving operators have nothing to do but attend to the machines, and beyond this the correctness of delivery depends in no way upon them.

The fundamental principle on which this system rests is synchronism, and the method of obtaining this in separately driven motors is very simple.

In Fig. 1 W and W' represent two wheels driven by separate powers at any distance apart. D is a stationary disc of insulating material, on which a brush, B, revolves with wheel, W. B is connected through a collector ring and stationary brush to line. Set into disc, D, and flush with it, is a small metal segment, S, which is connected through battery to ground. It is evident that every time B passes S a current will be sent to line. At

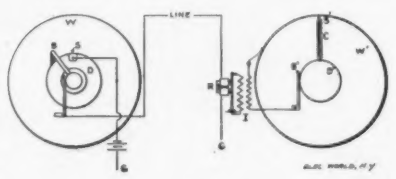


Fig. 1.

Fig. 2.

the receiving end the current is passed simply through a relay to ground. The back contact of the relay, R, is connected through a battery to the primary of an induction coil, I. One terminal of the secondary of the coil terminates in a knob, or can be electrically connected wit i the spark gap. The other terminal of the secondary is led through a brush, B', to a metal ring D', revolving with wheel, W', and thence through a heavily insulated conduit to a spark gap on the periphery of the wheel, at S'. We will now suppose the three possible cases of operation, viz.: W is running synchronously with, faster than or slower than W'. In the first case it is evident that as B touches segment S, a current will be sent to line, close the relay and produce a spark at the gap, which we will suppose at that instant to be at the highest point of its revolution. As both wheels under our first supposition complete one revolution in the same period of time, the spark will occur the next time at exactly the same point in space, and so on for each successive revolution, and if the speed is rapid, say 1000 r. p. m., as in practice, there will appear a continuous spark at one point, in fact, a miniature arc light, due to the continuity of impression on the retina. On the second supposition, that the receiving wheel is running faster, we will further suppose that it gains one inch, for an example, in each revolution. Then, if the first spark appears at the highest point on the wheel, the second spark will appear one inch in advance and the third one inch again in advance, and at rapid speeds the spark will appear traveling in the direction of rotation of the wheel. The method of synchronizing then is to simply apply friction until the spark appears stationary. On the third supposition similar reasoning to the above will show that the spark will appear to be traveling against the direction of rotation; the method of synchronizing then will be to speed up the motor by any of the usual regulating apparatus. In practice the receiving wheel is so run that its normal speed would be say 20 to 30 revolutions faster per minute than the sending. Then the only regulating apparatus needed is a slight pressure of the thumb on the periphery of the wheel. The synchronous stability is such that the attention of the operator can often be withdrawn from the spark for the space of a minute or two, and as for real attention it needs very little, and no thought whatever.

In this system the alphabet as such is discarded, and ten elementary marks substituted (see Fig. 2), of such shape that they can be combined to

form any letter of the alphabet. Three of these marks being the same, only differing in position, such as the vertical strokes of H and T, two characters are at once eliminated and the number of type necessary reduced to eight. In such a typewriter with only eight characters, all the type can be centered directly under the platen and can strike the paper by a movement of one thirty-second of an inch. In addition the type bars are made of aluminum and the inertia is very small.

In the complete machine in addition to the synchronizing segment, 10 other segments must be added to the insulated disc, *D*, Fig. 3. The top one is used as before for synchronizing, and the remainder are designated 1, 2, 3, etc., corresponding to the ten possible marks. While only eight type are used there must be ten possible positions for those eight type, and hence ten segments reserved for them. Fixed to the shaft is a little metal cylinder, *c*, on which the punched paper tape is carried. Above the cylinder and pressing upon it except when separated from it by the paper

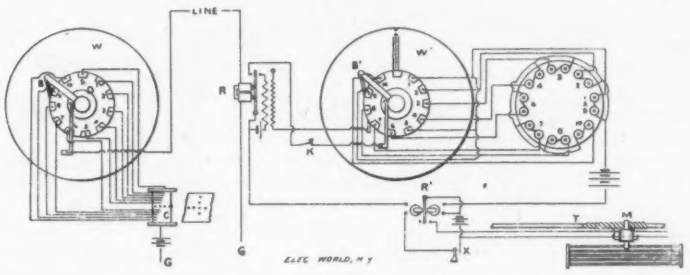


FIG. 3.

tape are ten metallic styluses, connected in regular order to the segments above mentioned. The metal cylinder is connected through battery to ground. The revolving brush, *B*, is connected through the collector ring and stationary brush to line. At the receiving end the line goes through relay, *R*, to ground, as in the simple synchronizing apparatus. The back contact of the relay is also arranged as before, but in this case the front contact is also utilized, for from it through a key, *K*, the circuit passes to the revolving brush, *B'*, on the receiving wheel, thence through whichever segment the brush happens to rest on to the corresponding magnet of the printer, thence to battery or other source of current and back to the relay armature completing the circuit. It matters not at all if the impulse of current lags on the line, and that therefore the brushes are not on the corresponding segments at the same absolute moment, for as much as the

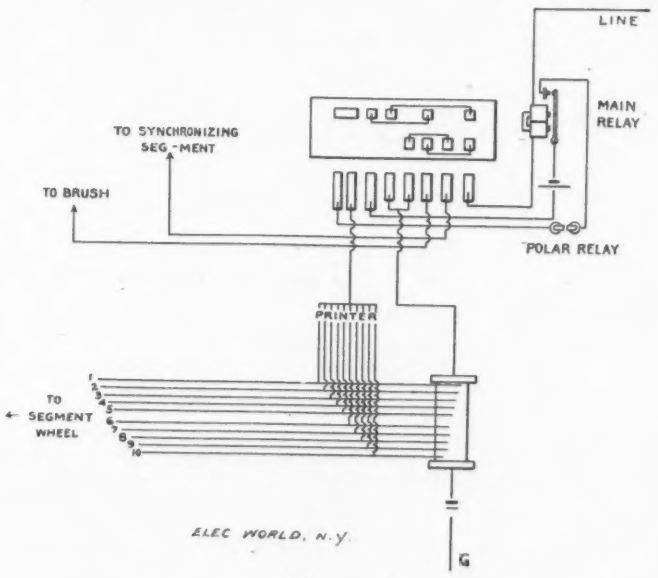


FIG. 4.

synchronizing impulse lags so do all the rest, and the brushes are relatively speaking on the corresponding segments at the same moment.

From Fig. 4 it will be seen that the holes are punched in a straight line. The styluses are so set that each succeeding one (Fig. 3), is a little shorter than the preceeding one. The cylinder beneath moves the paper tape the distance between successive rows of holes while the wheel and brush make one revolution. Hence shortly before the brush comes to No. 1 segment, No. 1 stylus falls into the hole cut for it, or is at the place the hole would be if cut, and so on for the rest of them. The hole gets to the stylus well in advance of the brush to the corresponding segment, and also leaves it sufficiently late to allow the brush to pass from the given segment, thus preventing the paper strip from breaking the contact; for that is done by the brush at the segment wheel.

The eight types were designed from the figure 4. It will be observed that angular or square letters can be made from this figure to represent any letter of the alphabet and at least two punctuation marks. These ten strokes are printed from eight type, arranged as shown in Fig. 2. The movement of the paper on the typewriter carriage from right to left brings the strokes to their proper position.

The printing portion of the machine is practically an electric typewriter, The eight magnets are arranged symmetrically in a circle, and the eight type grouped as above. As will be seen from Fig. 3, a common return from all the magnets is used, and in addition to that the circuits from No. 5 and

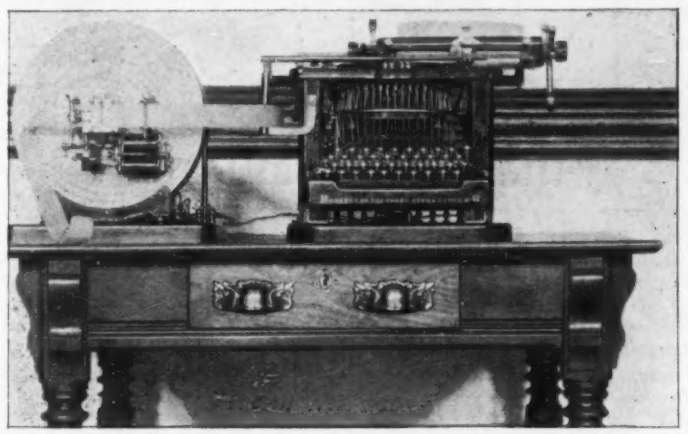


FIG. 5.

No. 9 segments pass through No. 1 magnet, as that is the magnet which operates the vertical stroke.

The method of working the page-printing device is very ingenious. The current after leaving the printing magnets passes by the common return through a polarized relay, *R'*, throwing the armature against one contact point, practically a single-pole switch. This closes the circuit to the trolley rods at the back of the printer carriage, and thence by two sliding contacts through the magnet *M* on the carriage, which is immediately attracted to and engages with a steel worm, *T*. This worm is a continuation of the wheel shaft, and the threads are so cut as to make the carriage travel at the speed to space the letters properly. When the carriage reaches the end of the line it closes another circuit by its forward movement at *X*, which throws the polar relay back to its open point and immediately releases the magnet from the worm. The carriage returns by a spring, or can be returned by a solenoid energized through the back contact of the polar relay. The recoil of the carriage on its return is absorbed by feeding the paper up to a new line and by an air cushion.

It is a simple matter to arrange one machine for both sending and receiving.

The machines as at present equipped use a battery current for the main line, a storage cell for the induction coil and the 110-volt direct current for

NO THIRTY-NINE CORTLANDT ST, ROOM TWENTY,
NEW YORK MARCH FIRST NINTY-SEVEN-

DEAR SIR,-- WE ARE PLEASED TO SEND YOU THIS SAMPLE OF RAPID PRINTING TELEGRAPHY- WE WRITE A LETTER ON A TYPEWRITER WITH A PERFORATER ATTACHED- WHEN THE LETTER IS FINISHED WE HAVE IT ALSO IN A PERFORATED TAPE- THIS IS FED INTO ONE MACHINE AND THE TYPEWRITER LETTER IS REPRODUCED AT THE OTHER END OF THE TELEGRAPH WIRE- THIS SYSTEM IS BASED ON RAPID SYNCHRONISM AND THE ELEMENTARY CHARACTERS OF THE ROMAN ALPHABET- PRINTED SINGLY THEY MAKE THESE EIGHT SIMPLE MARKS- . , ' - AS THEY ARE EMPLOYED IN COMBINATION THEY PRINT THE ALPHABET THUS- A- B- C- D- E- F- G- H- I- J- K- L- M- N- O- P- Q- R- S- T- U- V- W- X- Y- Z- THIS ACCOMPLISHES RAPID PAGE PRINTING TELEGRAPHY AND MAKES IT POSSIBLE TO SEND TWO HUNDRED WORDS PER MINUTE OVER ONE WIRE-

YOURS VERY TRULY, E- S- WORTON-

FIG. 6.

the printer, polar relay and carriage magnet. Fig. 5 shows the typewriter and electrical punch.

In Fig. 6 is shown a facsimile of a printed letter produced on the automatic receiver. Some of the characters at first sight have a peculiar appearance, but this disappears on a closer inspection, and the matter is easily read.

It is stated that the machines have operated successfully for weeks at a time on a line 40 miles in length, of No. 12 iron wire, poorly insulated, with unsoldered joints and ground return, in all kinds of weather. The system, we are informed, is now transmitting more than 200 words per minute, the operators needed for this being fully 60 per cent. less than the number of Morse operators to do the same work.

This system is the invention of Mr. J. Harris Rogers, of Maryland, some time pupil of Professor Henry, and the office of the company exploiting the same is at 39 Cortlandt Street, New York.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, June 21, 1897.

ELECTRICAL STOCKS.—There was more strength in this class of securities during the last week than the week previous, all changes recorded being advances. The sales of Edison Electric Illuminating of New York amounted to 370 shares, and those of Electric Illuminating of Brooklyn to 300 shares. The latter stock closed at a net advance of 1¼. Electric Storage preferred closed with a net gain of ¾. The sales of General Electric during the week were 73,074 shares, but the changes in quotations were merely fractional. In the bond list General Electric debentures dropped 1¼ points as compared with the last quotation.

TELEGRAPH AND TELEPHONE.—In general, telephone stocks, with the exception of American Bell, exhibited some firmness, slight advances being the rule. Bell Telephone closed at a price slightly lower than that recorded last week. Erie Telephone advanced 1 point, while New England receded ½. The telegraphs exhibited greater activity, Western Union closing with a net gain of 2¾ points. The sales of the stock during the past week were 45,462 shares. Commercial Cable advanced 3 points, and American Telegraph & Cable 2.

ELECTRIC TRACTIONS.—There was considerable activity in this class of securities during the past week and in almost every instance where changes are recorded advances took place. Brooklyn Rapid Transit was quite active, the sales for the week aggregating 25,333 shares, the closing price being 1¼ points over that of the previous week. Buffalo Street Railway was one of the few exceptions and declined 1 point. New Orleans common is 1 point higher, while the preferred stock shows an advance of 2 points. North Shore Traction was quite active and advanced 5 points, both in the common and preferred. West End closed at a figure 2½ points higher than last week's quotation, and Worcester Traction common is 1 point higher, while the preferred declined 2 points. Brooklyn Rapid Transit bonds of the 1945 issue advanced 2½ points.

DIVIDENDS.—The Edison Electric Illuminating Company of New York has declared a quarterly dividend of 1½ per cent., payable August 2. The Northern Electric Light Company, of Philadelphia, has declared a dividend of 5 per cent., payable July 1.

THE ELECTRIC STORAGE BATTERY COMPANY.—The annual report of the Electric Storage Battery Company for the fiscal year 1896, issued on June 19, shows gross sales of $646,000 against $328,000 in 1895; operating expenses, $504,000, leaving a profit of $142,000. Added to this is the income from royalty and investments of $7,000, making a total of $149,000. After deducting $14,000 for interest on bonds, the net profit is $135,000. In 1895 the net profit of the company was less than $3,000, and the report for 1896 shows an increase in net profits of $132,000.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Chicago Edison Company	100	110	..
Edison Electric Ill., New York	100	115	116
Edison Electric Ill., Brooklyn	100	108½	109¼
Edison Electric Ill., Boston	100	147	148
Edison Electric Ill , Philadelphia	100	..	..
Edison Ore Milling	100	7½	10
Electric Storage Co., Philadelphia	100	19½	19¾
Electric Storage, pref	100	21¼	22
General Electric	100	33½	33¾
General Electric, pref.	100	68	72
Westinghouse Consolidated, com	50	21	23
Westinghouse Consolidated, pref	50	50	51

BONDS.

Edison Electric Ill., New York, con. 5s	105	112	..
Edison Electric Light of Europe	100	75	85
General Electric Co., deb 5s	100	98¾	..

TELEGRAPH AND TELEPHONE.

American Bell Telephone	100	230	231
American District Telegraph	100	..	35
American Telegraph and Cable	100	90	93
Central and South American Telegraph	100	124	127
Commercial Cables	100	168	..
Erie Telephone	100	65	66
New England Telephone	100	104	104½
Postal Telegraph Cable	100	100	..
Western Union Telegraph	100	83¼	83½

ELECTRIC TRACTION STOCKS.

Baltimore Traction	25	19⅛	19¼
Brooklyn Rapid Transit	..	24¼	24½
Brooklyn Traction	100	..	14
Brooklyn Traction pref	100	46	48
Buffalo Street Railway	100	68	70
Cleveland Electric Railway	100	..	..
Columbus Street Railway	100	40	43
Hestonville	100	50	51
Hestonville, pref	..	..	62½
New Orleans Traction	100	7	9
New Orleans Traction, pref	100	28	31
North Shore Traction	100	23	26
North Shore Traction, pref	100	80	82
Rochester Street Railway	..	10	13
Steinway Railway	..	45	50
Union Railway (Huckleberry)	..	..	102
Union Traction, rcts $10 pd	..	12¾	13
West End, Boston	100	84¼	..
West End, Boston, pref	100	91¼	92
Worcester Traction	100	14	16
Worcester Traction, pref	100	90	94

BONDS.

Brooklyn Rapid Transit 5s, 1945	100	80½	..
Buffalo Street Railway 1st con. 5s	100	*106½	108¼
Cleveland Electric Railway 1st mtge., 5s	100	103	105
*Columbus Street Railway 1st 5s	100	94	96
Rochester Street Railway 1st 5s	100	..	100
Union Railway (Huckleberry) 1st mtge. 5s	..	105	107
*Westchester Electric 1st mtge. 5s	100	100	103

*With accrued interest.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, June 24, 1897.

POPULAR TRANSFORMERS.—Messrs. E. B. Latham & Co. are finding an increasing demand for Lakon transformers in the East.

MR. C. K. KING, of the Ohio Brass Company, Mansfield, Ohio, is in the city in the interests of his company. He made a pleasant call at the office of THE ELECTRICAL WORLD during the week.

REMOVAL.—Mr. Charles H. Warner, consulting electrical engineer, has removed from 50 Broadway to Bowling Green Building, 5-11 Broadway, where, with Mr. S. A. Strock, he has a very fine suite of offices.

MOTOR-PROTECTING DEVICES APPROVED.—The Edison Electric Illuminating Company of New York, has approved of nearly all the various over and under load motor-protecting devices recently submitted to it for test. Letters have been issued to the manufacturers to this effect.

OFF FOR EUROPE.—Mr. George F. Montgomery, of Montgomery & Co., will sail, on July 3, on the "Lucania," for a summer tour to Switzerland and Germany, and will also visit London and Paris. He will probably return by September 1. His many friends among the electrical fraternity wish him bon voyage.

IMPORTED LAMP FILAMENTS.—Mr. Reinhard Schmitt is now importing incandescent lamp filaments ready to be inserted into lamp bulbs. Mr. Schmitt is sole agent for several manufacturers in Germany, Belgium and France, and the product received by him seems to find general favor.

MR. W. J. CLARK, formerly with the Adams-Bagnall Electric Company, is now prominently associated with the United States Electrical Supply Company. Mr. Clark is the controlling spirit of this concern, which is about to be incorporated and will handle "W. J. C." incandescent lamps, X-ray apparatus and the Davis fluorometer.

MR. A. A. THRESHER, of the Thresher Electric Company, Dayton, Ohio, was a recent caller at the office of THE ELECTRICAL WORLD. Mr. Thresher came direct to New York from the Niagara Falls Convention, and seems to be thoroughly satisfied with his trip, having been awarded the contract for several large motor installations.

PERSONAL.—Mr. Sears B. Condit, Jr., manager for L. A. Chase & Co., Boston, Mass., called at the office of THE ELECTRICAL WORLD on his way to Boston from the West. The new Elden alternating-current circuit breakers and outlet box brought out by this concern seem to meet with general favor and Mr. Condit is quite well satisfied with the prospects for a strong demand.

ELECTRICALLY DRIVEN PRINTING PRESSES.—Mr. R. T. Lozier, of the Bullock Electric Manufacturing Company, is justly proud of the fact that Bullock electric motors are now being used to operate the largest printing presses in the world. In New York City alone several immense Hoe octuple presses are being, or are about to be, operated by direct-connected Bullock motors, with others to follow.

THE SIEMENS & HALSKE ELECTRIC COMPANY now transacts its entire Eastern business from its New York office. Mr. Charles D. Shain formerly represented this company in New York City. Mr. Charles E. Yerkes, president of the company, spends a great deal of his time in New York, but Mr. F. M. Armour is in charge of the New York business. The company is actively engaged in the development of various kinds of new machinery.

NEW COMBINATION GENERATING SET.—Messrs. Machado & Roller are expatiating upon the merits of a new generating set, including an exterior armature dynamo and vertical steam engine. The illustrations of this combination seem to indicate excellence in all respects. A. E. G. incandescent lamps and X-ray tubes are also in great demand, and Mr. Roller seems to be perfectly satisfied with these additions to the concern's specialties.

MR. GEORGE F. PORTER, secretary of the National Electric Light Association, is busily engaged in making arrangements for his coming business change. Mr. Porter will take active hold of the Brixey Kerite interests in this vicinity when his term as secretary of the association expires, but it is rumored that there is a general request for him to retain the secretaryship of the National Electric Light Association. Mr. Porter has not as yet decided whether he can give his time to both interests or not.

GOOD GOODS IN GOOD HANDS.—Mr. H. B. Kirkland, Beard Building, is now the New York representative for the American Circular Loom Company and the Cutter Electrical & Manufacturing Company. The new over and under-load circuit breakers and starting boxes recently brought out by the Cutter Company are being actively pushed by Mr. Kirkland in this district. Mr. Kirkland also has a great many good things to say about the new enamel-coated steel pipe brought out by the Circular Loom Company.

COLUMBIA'S NEW BUILDINGS.—An exceedingly beautiful and artistic booklet has just been issued by the Columbia University, New York City, describing with very complete illustrations and plans the new college structures which are about completed in the upper part of the city. In perusing the pamphlet one is struck with the great attention given to detail of description and the exactness of the plans. It is stated that the latter even include each bench in the various classrooms and its exact location. Unquestionably the new home of this now very prominent institution of learning is entirely in keeping with the dignity of its position in the scientific world.

AN ELECTRICAL SHOW.—It is proposed to illustrate the development of practical electrical science by exhibits at the next American Institute fair, The fair will be held at Madison Square Garden, from September 20 to November 4 next, and the managers will be pleased to see the electrical section made, if possible, the most important of all the fair's departments. The electrical section will include everything pertaining to telegraphs, telephones and their construction, signals and alarms, dynamos and motors, electrical medical and surgical apparatus and instruments, electric lighting devices, and models of or apparatus and instruments used in electrical processes. Mr. Alfred Chasseaud is the general superintendent of the fair and will be glad to give any interested person further information on the subject, by application at his office at 111-115 West Thirty-eighth Street.

LARGE FOREIGN CONTRACT FOR AMERICAN ELECTRICAL APPARATUS.—The General Electric Company, through its English representative, the British Thomson-Houston Company, has been awarded the contract for the electrical equipment, motors, etc., for the Central London Railway. This is the new underground road, and unquestionably is the forerunner of many other similar changes. The contract involves the expenditure of about £275,000. The award of the contract was due to the efforts of the manager of the European company, Mr. H. F. Parshall, and Messrs. Rice & Clark, of the American company. This large order for American electrical machinery, in conjunction with others that have been previously noted, certainly speaks most favorably for American apparatus, and shows that its merits are being recognized by our European cousins.

NEW ENGLAND NOTE.

Branch Office of THE ELECTRICAL WORLD
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., June 23, 1897.

IMPROVED GRAVITY BATTERY.—The Burnham-Gethins Company, Boston, reports excellent results in the battery business, which is a specialty with this concern. The Gethins improved gravity battery seems to be peculiarly adapted to telephone service owing to its high efficiency and very long life, having 700 ampere hours' capacity at a discharge rate of 100 milliamperes, together with its perfect cleanliness and freedom from vapors. The soft rubber covering effectually prevents evaporation, creeping of salts or spilling of the solution through careless handling. It is claimed that the improved form will do four times the work of the ordinary gravity cell, and will last five times as long with one-tenth the labor. Another strong point which the company claims is that it is the only battery which is being successfully used for charging storage cells for low power. The method is certainly very convenient, where direct current is not available, since it is only necessary to connect a set of charging cells to the storage cell and the user may feel sure that the current will be ready at any time. Dentists, physicians and surgeons have been quick to appreciate these important features, and are rapidly availing themselves of the combination.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., June 21, 1897.

ELECTRICITY IN ELEVATORS.—Niagara power is becoming popular with Buffalo grain elevators, and before long the Northern Elevator will have adopted electric power brought from the Falls. It is stated that 450 horse-power will be required for its operation.

DEATH OF A PROMINENT BUFFALO BUSINESS MAN.—Mr. John L. Williams, one of Buffalo's leading business men, died of heart disease on June 16. Mr. Williams was connected with various electrical concerns for several years, and at the time of his death occupied the positions of treasurer of the Buffalo, Bellevieu & Lancaster Railway Company and director of the Buffalo Railway Company, in which company he was one of the principal stockholders.

THE BUFFALO TRACTION COMPANY.—One of the chief topics in Buffalo at the present time is the plans of the Buffalo Traction Company—what it is doing, and what it intends to do. For some time past many of the poorer classes of citizens who are out of work have been eagerly looking forward to the day when the Traction Company should commence the construction of its lines. On Wednesday morning last when work on the first section of the new system was begun in East Buffalo, nearly 2000 Poles were at the place seeking employment. Two or three hundred of these men were given work, and the rest, driven to extremities by disappointment and want, held an indignation meeting. They were addressed by Baron Rheinstein, an alleged anarchist, who urged them to demand work of the city. This idea caught the fancy of the crowd and soon 1500 Polish and German laborers were marching to the City Hall armed with picks and shovels and carrying banners, on which were inscribed the words: "We Want Work or Bread for Our Wives and Children." The police were called out, but the Mayor succeeded in pacifying the mob through promises, and the men dispersed. In pursuance of this promise, the Mayor has since suggested to the Traction Company that it divide its employees into two gangs, the members of which shall work half time each, and the company has declared itself willing to follow this course. As the company is required by law to pay at least $1.75 a day for its labor, this will furnish a small living to twice as many poor people as before.

PITTSBURG NOTES.

PITTSBURG, Pa., June 21, 1897.

TROLLEY CARS FOR BICYCLES.—The Second Avenue Traction Company has established on the Perrysville Avenue line of its North Side division, a car service for the special benefit of bicycle riders who wish to enjoy the fine roads and beautiful views out Perrysville Avenue. This region has been inaccessible to many riders on account of the long hills that must be traversed in order to reach it. The new bicycle cars will be run at fifteen-minute intervals every evening during the summer; also on Saturday afternoons and all day on Sundays. The cars are arranged with bicycle racks on one side and seats on the other, and a fare of 15 cents is charged for wheel and rider from the city to any point on the line.

CONSOLIDATION OF ELECTRIC ROADS.—In pursuance of the consolidation scheme, which was described recently in THE ELECTRICAL WORLD, notices have been sent to the stockholders of the Northside Traction Company, stating that a special meeting will be held on June 26, at 9:30 o'clock A. M., to consider and vote upon a proposition to lease and sell the property and franchises of the company to the United Traction Company of Pittsburg. A meeting of the stockholders of the Second Avenue Traction Company is called for 11:30 o'clock, on June 26, and a meeting of the stockholders of the Pittsburg, Allegheny & Manchester Company, at 2 o'clock P. M., on the same day, to act upon similar propositions from the United Traction Company. The United Traction Company was incorporated for the purpose of acquiring these three lines, together with that of the West End Traction Company.

LAST OF THE CABLE CARS.—On Monday night, June 14, the last cable car to run in Pittsburg made its final trip over the Citizens' Traction Company's tracks, and, with its comrades, was run into the car barn for retirement. The cables were immediately pulled out of the conduits, and the work of tearing up the cable tracks and conduits was started the next day. Soon after the property of the Citizens' Company was leased by the Consolidated Traction Company, the East Liberty branch was changed over from cable to electric power, but the cables on the Butler Street branch and on the main line between Thirty-fourth Street and the city were kept in operation all winter and have just been abandoned. The Butler Street branch will be reconstructed, one track at a time, while the other track is operated as a single-track trolley line. The traffic on the main line during reconstruction will be taken care of by the cars on Liberty Street. Every street car in Allegheny County is now run by electric power, save those on one short connecting line, crossing the Allegheny River on the Forty-third Street bridge, which is still operated by mule power.

HOTEL GUESTS CAN'T HAVE THE FREE USE OF TELEPHONES.—The Central District & Printing Telegraph Company has notified all the hotels and restaurants using its telephones that the service is for the sole use of the subscribers and their employees, and that hotel guests will not be allowed the free use of the instruments and connections. Therefore, anyone desiring to use the telephone in a hotel must first prove that under this rule he is entitled to do so. If he cannot do this to the satisfaction of the operator, he is politely requested to try the nearest pay station. The enforcement of this rule has caused a great deal of complaint, and a meeting of hotel men was held a few days ago for the purpose of devising an effective protest against its operation. It was decided to form a permanent organization of hotel men for the protection of their interests, but it was pretty clearly shown that they were at the mercy of the Bell organization, and that their only hope was in the success of the Home Telephone Company, or some other independent concern. In the meantime several of the hotels have ordered the removal of their telephone instruments.

Chicago Notes.

Branch Office of The Electrical World,
936 Monadnock Building,
Chicago, Ill., June 23, 1897.

VISITED NEW YORK.—Mr. James Wolff, Western manager for the New York Insulated Wre Company, spent a few days in New York last week.

AFTER EASTERN BUSINESS.—Mr. F. S. Terry, of the Sunbeam Incandescent Lamp Company, Chicago, is making an extensive business trip throughout the Eastern States in the interests of his company.

MR. H. M. UNDERWOOD, of the firm of H. M. Underwood & Co., of this city, is doing an excellent business in his fine line of novelties, which he is now handling. He reports a decided improvement in trade in general.

St. Louis Notes.

St. Louis, Mo., June 21, 1897.

RAILWAY WAR.—More trouble is threatened between the Citizens Company and the Grand Avenue Company over the stretch of track from Easton Avenue to the Fair Grounds. Both roads use the same track, and there is a controversy over the repairs and rental. The case is now in the Supreme Court for final adjudication.

BIG DEPOSIT.—The Citizens Electric Light & Power Company made the largest deposit ever made in connection with the tearing up of the streets, to insure their proper repair. A cashier's check for $24,650 was given to the City Treasurer Monday. The deposit is to secure the city while the company builds 125 duct miles of conduit. The city always exacts a deposit of $25 for each 75 feet of street surface torn up. If the surface is properly restored, the deposit is returned.

CONTRACT FOR CABLES.—The Kinloch Telephone Company has closed the contract for all the cable to be used in the establishment of its new system of telephones in St. Louis. The contract, like that of the Bell Company, will probably go East, as the Standard Underground Cable Company, of Pittsburg, was the lowest bidder. The Kinloch equipment is somewhat different from that of the Bell, its cables being 100 pairs, 75 pairs, 50 pairs, and so on, instead of 120 and fractions, like the Bell. It will require about 375,000 feet of cable for its equipment. Of this 300,000 feet will be for underground service.

MAY BE CUT DOWN.—Unless the ordinance introduced in the City Council recently, which makes it possible for any wire-using company to place its wires underground, is passed, the Western Union Telegraph Company will be left in an embarrassing position. The company has not availed itself of its privilege to go underground under the Keyes ordinance, and yet, if its wires are not buried before December 31, 1898, its poles will be chopped down as were the poles in New York City after the subway ordinance went into effect there. The ordinance now pending gives the right to any and all wire-using companies to put their wires under the street at any time.

Pacific Coast Notes.

San Francisco, Cal., June 11, 1897.

TWENTY-TWO MILES AT A PRESSURE OF 15,000 VOLTS.—It is stated on good authority that one of the several "San Gabriel Canyon" water-power electric schemes will be carried to a conclusion. One thousand horse-power will be transmitted a distance of 22 miles to Los Angeles, Cal., at a pressure of 15,000 volts.

UNDERGROUND THREE-WIRE SYSTEM.—It is reported that the West Side Lighting Company, Los Angeles, Cal., has bought the interests of the Edison Company, and will proceed to install an underground three-wire system. The West Side Company has closed a contract with the Southern California Power Company for 1,000 horse-power, which is to be available February 1, 1898.

CONTRACTS AWARDED.—The details of the contracts recently awarded by the Southern California Power Company, for a water-power electric transmission to Los Angeles, Cal., include the following: To the General Electric Company, three 750-kw three-phase generators, of 50 cycles frequency; twelve step-up transformers, to raise the voltage to 33,000 for transmission; all switchboard and generating-station apparatus; to the Westinghouse Electric & Manufacturing Company, all sub-station work and lightning protection, the latter to be of the Wurts' system. In the sub-stations will be installed six 500-hp synchronous motors, of 50 cycles (to be changed, later, to rotary transformers); one 300-hp synchronous motor, to be temporarily used as a generator; the reducing converters, from 30,000 volts, primary. The step-down transforming units will be of 250-kw and 150-kw capacity, of Westinghouse self-cooling, oil-insulated type. The Southern California Power Company has acquired several additional sources of water-power, so that there is ultimately available for this system a force of 25,000 horse-power.

THE SOUTHERN CALIFORNIA POWER COMPANY recently awarded the contracts for the generating and distributing apparatus for its 80-mile transmission line from a point on the Santa Ana River, 12 miles from Redlands, Cal., to Los Angeles. The General Electric Company received the contract for the power-house equipment, including generators. The Westinghouse Electric & Manufacturing Company will equip the sub-stations, of which there will be two in Los Angeles and the same number in Pasadena. The John A. Roebling's Sons Company was awarded the contract for the 600,000 pounds of copper wire required for the main circuits. The pole line will be constructed by the Power Company under the supervision of Chief Electrician Ensign, who prepared the plans. There will be two three-phase circuits of No. 1 hard-drawn copper wire. The poles will be planted 110 feet apart, ranging from 35 to 50 feet in height. The 50-foot poles will have 12-inch tops. The insulators will probably be of glass. The generators will be connected in multiple. The current, which will be generated at not to exceed 1000 volts, is to be transformed to a pressure of 33,000 volts for transmission. About 10,000 horse-power is available from the Santa Ana River supply. The working head of water will be 750 feet. Water will be diverted from the river at its junction with Bear Creek and carried 3½ miles through a flume and rock tunnels to a pipe 2200 feet in length, which will conduct it to the water wheels in the canyon beneath. The hydraulic equipment is expected to cost about $90,000. The bids for four units of 1000 horse-power each were opened at Redlands. Manager H. H. Sinclair and Chief Electrician O. H. Ensign spent a week in San Francisco in conference with the Pacific Coast representatives of the electric manufacturing companies before awarding the contracts. Long-term contracts for electric power have been closed with the West Side Lighting Company, Los Angeles; the Pasadena Electric Light & Power Company, and the Los Angeles & Santa Monica Railway Company. Each of the companies will use 1000 horse-power. The entire system will probably cost $500,000, and will be ready for operation in February, 1898.

Virginia Notes.

Richmond, Va., June 19, 1897.

TELEPHONE FRANCHISE GRANTED.—Messrs. Langham & Hull, of Pulaski, Va., have been granted a telephone franchise and will have their exchange ready for public use within six months from July 1.

TO KEEP CARS CLEAR OF BOYS.—At Alexandria, Va., two policemen have been detailed to ride on every electric train passing up and down King Street, to prevent boys from riding on the cars, with a view to avoiding accidents.

TO COMMENCE BUILDING.—The Portsmouth Railway Company, Portsmouth, Va., having made a satisfactory contract with the city, will begin work very soon. The company claims that it has plenty of money with which to complete the road.

A HARD FIGHT.—The Richmond Common Council will on July 8, take up the proposal to grant a telephone franchise to the American Telegraph & Telephone Company, of Virginia, to conduct both a local and long-distance telephone business in Richmond. This ordinance did not pass the committee without a hard fight, and it is probable that the Council will deliberate over the matter as fully as the importance of the subject demands.

English Notes.

(From Our Own Correspondent.)

London, June 16, 1897.

ELECTRICITY AND THE ILLUMINATION OF THE FLEET AT SPITHEAD.—The illumination of the great fleet now assembled at Spithead for review by the Prince of Wales, on June 26, has resulted in the director of navy contracts making a large purchase of electrical stores, including 25,000 yards of cables, 40,000 yards of wire, 25,000 16-cp lamps, 15,000 8-cp lamps, 50 100-cp lamps, besides a large quantity of electric light fittings.

THE SECRETARY OF THE INSTITUTION OF ELECTRICAL ENGINEERS.—On Monday evening an informal gathering of some forty members of the electrical industry was held at the Whitehall Club, the occasion being a dinner given by the electrical members of the club to Mr. F. H. Webb, the retiring secretary of the Institution of Electrical Engineers. Lord Kelvin presided, and among those present were Sir Henry Mance (president of the Institution of Electrical Engineers), Dr. John Hopkinson, Prof. Silvanus P. Thompson, Prof. W. E. Ayrton, Prof. Perry, Mr. R. E. B. Crompton, Dr. J. A. Fleming, Mr. Alexander Siemens, and other representative leaders of the electrical industry in this country.

ELECTRICAL ENGINEER VOLUNTEERS.—As I informed you in a recent letter, the suggestion made by Dr. John Hopkinson, when president of the Institution of Electrical Engineers, that a corps of electrical engineer volunteers should be formed to take part in the national defense, was welcomed by the War Office, and in a recent gazette the authorization of the corps was announced, with Dr. John Hopkinson as commanding officer. Since then Lord Kelvin has been appointed honorary colonel; several well-known gentlemen, such as Mr. R. E. B. Crompton, have decided to accept commissions in the corps, and an adjutant, in the shape of a lieutenant in the Royal Engineers, has been appointed. Particulars with regard to the objects of and rules governing this corps have now been published. The corps will, at the start, be about 250 strong, and will be recruited, so far as the privates are concerned, from the rank of electrical and similar artisans, the officers and non-commissioned officers being supplied mainly from members of the Institution. At present it is thought that the corps will form a useful addition to the number of men trained to work search lights in connection with the defense of our fortified ports. It is proposed to immediately commence active recruiting and to make a start with drills and camps before the end of the present volunteer year.

General News.

New Incorporations.

THE CITIZENS ELECTRIC LIGHT COMPANY, of Decatur, Ind., has been incorporated, with a capital stock of $50,000.

THE DELHI TELEPHONE COMPANY, Delhi, N. Y., has been formed with a capital stock of $3000. The directors are H. S. Graham, M. O. Landon, W. I. Mason, S. F. Adee, of Delhi, and others.

THE CRETE TELEPHONE COMPANY, Crete, Ill., has been incorporated with a capital stock of $1000. The incorporators are Charles Blim, W. H. Rohe and H. J. Hartman.

THE NOBLE LAKE & SOUTHERN RAILWAY COMPANY, St. Louis, Mo., has filed articles of incorporation with the Secretary of State. Among those interested are E. P. Ladd, G. S. Bacon and Addie Bacon. Capital stock, $10,000.

THE GRANGE TELEPHONE COMPANY has been incorporated at Rushville, Ill. The incorporators are C. L. DeWitt, S. C. Swisher, James A. Teel, Thomas Harber, George H. Lambert, Jeff E. Thompson, J. S. Howell, Otto S. Turner and H. T. Teel.

THE McKEESPORT, MONONGAHELA & FINLEYVILLE RAILWAY COMPANY, McKeesport, Pa., has been incorporated for the purpose of building a line 18 miles long. J. L. D. Speer, of Pittsburg, is the president of the new company. Capital stock, $110,000.

THE CLEVELAND & AKRON SUBURBAN ELECTRIC RAILWAY COMPANY has been formed at Columbus, Ohio, with a capital stock of $500,000. The incorporators are Harry C. Mason, William C. Gayer, Dr. J. C. Fritch, J. A. Spitzig and Frederick L. Taft.

THE WINTHROP STREET RAILWAY COMPANY, Winthrop, Mass., has been incorporated with a capital stock of $80,000. The incorporators are W. G. Wheildon, Samuel G. Irwin, William W. Davis, Edward F. Draper, George F. Forbush, Charles E. Folsom and Aaron R. Sanderson.

THE HUBBELL ELECTRIC LAMP COMPANY, Scranton, Pa., has been formed for the purpose of manufacturing the Hubbell electric lamp for bicycles and miners. The officers are: Capt. C. J. Hubbell, president; Dr. L. M. Gates, vice-president; W. D. Boyer, secretary and treasurer.

THE DOUGLASVILLE RAILWAY COMPANY has been incorporated at Atlanta, Ga., for the purpose of constructing an electric road between Atlanta and Douglasville. The incorporators are J. S. James, C. D. Camp, R. E. James and A. E. Watson, of Douglasville; Simon Baer and Charles Pratt, of Atlanta; George L. Bell, of Gainesville; T. L. Galloway, of Decatur; George F. Payne, William D. Gharkey and Charles G. Witter, of Philadelphia. The capital stock is $375,000.

THE LOS ANGELES OCEAN POWER COMPANY, Los Angeles, Cal., has been organized with a capital stock of $1,000,000. Those interested are Charles E. Day, H. W. Vail, S. C. Ward, George H. Parker, Dr. Kazimierz Midowicz, C. W. Sanders, all of Los Angeles, and St. George T. C. Bryan, of San Francisco. The purpose of the company is to acquire the ownership of or the right to use and control patents for wave motors and improvements thereon.

THE TELEGRAPH AND TELEPHONE.

BUTLER, OHIO.—A new telephone office has been established in this place.

WAVERLY, OHIO.—The Columbia Telephone Company has commenced building its line to Omega.

ORONOCO, MINN.—The Union Electric Company has completed its telephone line from Pine Island to this place.

WINTHROP, MINN.—A telephone line will be built from this place to Henderson via Gaylord and Arlington.

TROY, OHIO.—The Central Union Telephone Company has secured a twenty-five years' franchise to continue business in this city.

PORTLAND, ORE.—The Sunset Telephone & Telegraph Company has applied to the city authorities of Blaine for a franchise to extend its system in that place.

CHENOA, ILL.—The Home Telephone Company has been granted the privilege of building a line in this city, and work on the same will be commenced in the near future.

GALVESTON, TEX.—It is stated that the Gulf, Beaumont & Kansas City Telephone Company proposes to change its telephone line from Beaumont to Kirbyville to a telegraph line.

MANITOWOC, WIS.—A franchise has been granted to the Sheboygan & Manitowoc County Telephone Company to build a line to connect Manitowoc with Elkhart Lake, Rhine, Franklin and other places.

SHELTON, NEB.—The Nebraska Telephone Company has been granted right of way through this village, and the company expects to have the line in operation to Wood River and Gillan by August 1, next.

MACON, GA.—A deal has been completed between the Southern Telephone & Telegraph Company, of Valdosa, and the Savannah Telephone Company, by which the former concern will connect with the exchange of the Savannah Telephone Company.

MORRISTOWN, N. J.—On July 1 the New York & New Jersey Telephone Company will begin laying underground conduits for telephone wires through the streets. The city, according to the ordinance granting the permission, will receive $50 annually for each mile of conduit laid.

MONTGOMERY, ALA.—During a storm on June 19, lightning struck a wire leading into the Western Union Telgraph office in this city, setting fire to the office. The entire office equipment, together with the building, was destroyed. The company opened a temporary office across the street.

SIOUX CITY, IA.—The Home Telephone Company has commenced the extension of its line from South Sioux City to Dakota City, Jackson, New Castle and other places. If sufficient encouragement is given to the enterprise a wire will be strung from Dakota City to the Winnebago Indian Agency.

MANKATO, MINN.—It is stated that the franchise of the North Central Telephone Exchange Company to put in a local exchange in this place has been forfeited, together with the deposit, the company having failed to begin work on the exchange, although granted two extensions of time by the Council. The Blue Earth Valley Telephone Exchange Company, it is stated, will now establish a local exchange in opposition to the Northwestern Company, which is the sole occupant of the field at the present time.

ELECTRIC LIGHT AND POWER.

BURLINGTON, VT.—The voters of Enosburg Falls at a recent election decided in favor of establishing an electric light plant to be run by the town.

NEGAUNEE, MICH.—The workmen employed on the new municipal electric light plant a few days ago struck for more pay, and were granted their demand for $1.50 per day.

HARRISBURG, PA.—The Pennsylvania House of Representatives passed a bill a few days ago, the object of which is to compel municipalities to purchase existing electric lighting plants before erecting substitute plants of their own.

FLEMINGTON, N. J.—The Flemington Electric Light Company has purchased a new engine, a new boiler and a new electric light generator, all of which will be installed by September 1. Various improvements have been incorporated in the new plant.

SEDALIA, MO.—This town was a few days ago visited by a fierce electric and wind storm. The power house of the Sedalia Electric Railway & Power Company was struck by lightning and eleven of the generators ruined, leaving the city without street lights and stopping all of the six car lines.

MANCHESTER, N. H.—The stockholders of the Manchester Electric Light Company have voted an issue of bonds to cover the extensive improvements made on its property during the past year, and to purchase land. The bonds will be issued at a rate not exceeding 5 per cent. to refund $80,000 of 6 per cent. bonds now outstanding, and to pay the floating indebtedness of the company incurred by the improvements. All the contemplated improvements it is thought will be finished by September.

WARREN, PA.—The annual meeting of the Electric Light Company was held a few days ago, and the following new officers were elected: President, J. P. Jefferson; secretary and treasurer and superintendent, J. K. Simpson; directors, J. P. Jefferson, A. J. Hazeltine, C. W. Stone, C. W. Sill, C. H. Noyes and R. F. Van Doorn. The company contemplates making extensive changes and improvements during the coming year. Mr. Simpson, the new superintendent, was formerly manager of the Western Union Telegraph office of this place.

CHICAGO, ILL.—Four of the electric light companies of the South Side have been consolidated as a result of negotiations carried on by Hirsch Brothers & Co. They are the Hyde Park Electric Light & Power Company, the Thomson-Houston Electric Light Company, the Chicago Illuminating Company and the Englewood Electric Light Company. It is stated that $750,000 in bonds have been placed in the East. This amount will wipe out a floating indebtedness of between $300,000 and $400,000, and leave a surplus for improvements. The name of the consolidated company has not yet been announced. Its capital stock will be $2,000,000.

THE ELECTRIC RAILWAY.

HOLLAND, MICH.—Work has been commenced on the new electric road from Holland to Macatawa.

BUFFALO, N. Y.—The City Council has approved of the plans of the Traction Company for the construction of the first 15 miles of its proposed road.

ALBANY, N. Y.—The State Railroad Commission has granted the application of the Greenbush & Nassau Electric Railway Company for permission to construct its road from Renssalaer to Brainard Station.

WESTBORO, MASS.—The long-talked-of electric road from Northboro will soon be connected with Westboro. It is expected that as soon as the line from Marlboro to Worcester is completed this end of the line will be pushed.

NEW BRIGHTON, S. I.—Lightning burned out several of the coils on one of the large dynamos of the Staten Island Electric Light Company at this place, and the electric railway was inconvenienced for a short time on account of the storm.

PHILADELPHIA, PA.—An effort is being made to pass through the City Councils an ordinance authorizing the Northwestern Passenger Railway Company to lay tracks upon a number of streets, among which is included Oxford Street.

EATONTOWN, N. J.—The Redbank Trolley Company has filed its acceptance of the franchise as drawn up by the Township Committee. The trolley company must pay half the cost for maintaining the street it occupies, besides a payment of $250 annually for the franchise.

BOSTON, MASS.—The stockholders of the Brockton, Bridgewater & Taunton Street Railway Company have voted to petition the Railroad Commissioners to approve the present issue of $200,000 worth of stock, and also to secure approval to an increase in capital stock of $50,000.

CLEVELAND, OHIO.—The Cleveland & Eastern Railroad Company has decided to accept the terms of the County Commissioners and a franchise will be given it. The company will be required to operate its road by electricity and carry only barrel and package freight. The road will run along Mayfield Road through three or four counties to the east and south.

MECHANICS FALLS, ME.—The stockholders of the Oxford & Welchville Electric Railway Company a few days ago elected directors for the ensuing year. The company has applied for a charter under the general law, to build a line from Oxford to Welchville. It is capitalized at $25,000. The plans and estimate of cost of construction, equipment, etc., have been made, and in case the Railroad Commissioners approve of the location, work will be commenced at once. The road will be 2½ miles long. Officers were elected as follows: George Hazen, president; G. W. McFadden, vice-president; and John B. Robinson, treasurer.

ITHACA, N. Y.—At a special meeting of the directors of the Ithaca Electric Company, ex-Judge Alfred Hand disposed of his interest in the property to Messrs. H. Bergholtz and E. G. Wyckoff on account of ill health. He will seek rest and recuperation. The directors of the company accepted the resignation of Judge Hand as president and director, and elected in his stead

as both director and president Mr. E. G. Wyckoff. The resignation of Hon. William Connell, of Scranton, Pa., was also tendered and Mr. Charles J. Rumsey, of Ithaca, was chosen to fill the vacancy. Mr. Bergholtz continues in the relation of director, secretary, treasurer and manager.

BALTIMORE, MD.—The consolidation of the Baltimore Traction Company and the City & Suburban Railway Company was effected on June 18, and the new company organized under the corporate title of the Baltimore Consolidated Railway Company. The consolidation became effective at once. The officers of the new company are: President, Nelson Perin; vice-president and general manager, William A. House; secretary, James F. Heyward; treasurer, Frank S. Mambleton; Executive Committee, Nelson Perin, president ex-officio; George C. Jenkins, T. Edward Hambleton, William T. Dixon, and Edward L. Bartlett; directors, T. Edward Hambleton, George C. Jenkins, James S. Hagerty, William P. Harvey, William T. Dixon, Jesse Hilles, Edward L. Bartlett, Charles Adler, William A. House, Nelson Perin, George A. Von Lingen and Theodore F. Wilcox; counsel, Judge E. J. Cross and Mr. F. C. Slingluff. The capital stock of the company is $10,000,000, with the par value of each share $25. A mortgage was executed in favor of the Mercantile Trust & Deposit Company for $12,000,000, to run for 100 years, with interest at the rate of 4½ per cent. The money will be used to retire the divisional mortgages of the old companies, aggregating $10,550,000. Under the agreement the City & Suburban stock is to be exchanged at par ($50), while the Traction Company's stock is to be exchanged at a valuation of $21, or at the rate of 84 per cent. of its stock, the par value having been $25. It is thought that an effort will soon be made to get the Baltimore City Passenger Railway Company to join in the consolidation.

Obituary Note.

MR. EUGENE E. BOGART, doing business under the name of A. L. Bogart, at 22 Union Square, New York City, died on the morning of June 24, from the result of injuries received by being thrown from a cable car on February 5 last. Mr. Bogart succeeded to the business of Mr. Abraham L. Bogart, his father, who died suddenly on July 25, 1896.

Trade and Industrial Notes.

DEMAND FOR POLES, ETC.—Mr. S. A. Strock, New York, the well-known dealer in railroad ties, wooden poles, etc., reports an active demand for lumber for electrical purposes.

ASSIGNMENT.—We have received notice of the general assignment of the Electric Engineering & Supply Company, of Syracuse, N. Y., for the benefit of creditors. This action was taken on June 22.

ELECTRICITY ON A CHICAGO "L" ROAD.—The motors for the Alley "L" road in Chicago, for the electrical equipment of which Mr. Frank J. Sprague recently closed a contract, will be furnished by the General Electric Company.

MESSRS. C. B. STERLING & CO., New York City, have secured the sole agency for the sale of the products of the Standard Electric Lamp & Novelty Company, New York, consisting of miniature incandescent lamps. They have also secured the agency for the new "Fortosec" dry battery, recently placed upon the market.

POWER PRESSES.—A complete and well-illustrated catalogue has just been issued by the Stiles & Fladd Press Company, Watertown, N. Y., of its power and foot presses, rock hammers, dies, power shears and special machinery, for working of metals in the sheet or bar, etc. These machines embody all the modern methods of construction.

REFLECTORS FOR TELEPHONE SWITCHBOARDS.—We are informed by I. P. Frink, New York, that his new reflector for lighting telephone switchboards has been adopted by the New York Telephone Company, the New York & New Jersey Telephone Company and the New York & Pennsylvania Telephone Company. He says the reflector has met with marked success in this application.

THE TRANSMISSION OF POWER.—The many methods of mechanical transmission of power are well illustrated in a large catalogue of power transmission appliances just issued by the Rice Machinery Company, Chicago, Ill. This concern manufactures a full line of power-transmitting apparatus, elevating and conveying machinery and is, besides, contractor for complete transmission plants. The catalogue is very fully illustrated.

A VALUABLE DIRECTORY.—"The Textile World," Boston, Mass., has issued a directory of the mill trade and of large buyers of textile fabrics. It is a book of 360 pages, full of information concerning the textile industry, and contains a complete directory of all such establishments in the country, with detailed information concerning each mill, its products, capacity, etc. The price of the work is $3 and $2 for board and paper covers.

ALL ABOUT TELEPHONES.—A complete little telephone catalogue has been issued by the Farr Telephone & Construction Supply Company, Chicago. The Farr telephone apparatus has acquired a considerable reputation among telephone users, and, it is stated, are very efficient instruments. The catalogue describes and illustrates all sorts of telephone accessories, and gives, besides, several diagrams to facilitate the work of installing telephones.

A POPULAR PACKING.—The Garlock Packing Company, Palmyra, N. Y., has drawn plans for a large extension and increase of capacity of its Palmyra factory. Ground has already been broken for an additional building which, when complete, will nearly double the present plant. The company reports that its business is constantly increasing, notwithstanding the fact that business in general is not brisk, and in order to keep up with its orders and fill them promptly, it finds it necessary to run its plant overtime.

ELECTRIC SOLDERING IRON.—The Electric Appliance Company, Chicago, has been very successful in the introduction of the American electric soldering iron, and is preparing a circular giving a few of the many testimonial letters received from customers, in regard to the operation of these irons. Many users state that the American iron is the most successful one on the market. The Electric Appliance Company anticipates a large sale of these goods, as a satisfactory electric soldering iron has long been called for.

IN A RECENT TEST, in Canada, by the largest telephone company there, a trial order of five "O. K." dry batteries was given, with the result that the "O. K." has now superseded all other batteries, wet or dry, ever tried by this company. Five large duplicate orders have been received from this company during the past few months. Many of the largest railroads have also adopted the "O. K.," as have many manufacturers of gas engines. The "O. K." dry battery is manufactured by the Non-Polarizing Dry Battery Company, New York.

REMOVAL ANNOUNCEMENT.—Messrs. Dyer & Driscoll, the well-known patent attorneys, have removed their offices to 31 Nassau Street, corner of Cedar, New York. They had outgrown their old quarters at 36 Wall Street and increased accommodations became absolutely necessary in order to better carry on their increasing business. In their new quarters the firm occupies a wing on the twelfth floor, affording plenty of room for the large force now employed. The firm will continue to give special attention to work requiring high-class services, particularly in connection with electrical inventions, patents and litigations thereon.

THE BINGHAMTON RAILWAY.—The Binghamton Railroad Company, Binghamton, N. Y., has issued a handsomely illustrated pamphlet showing features of interest in and around Binghamton. Mr. G. T. Rogers, president of the company, is one of the most enterprising electric railway officials in the United States, and knows how to present the good points of an electric railway system in the very best light possible. Other managers of electric railways will be interested in this pamphlet, from the fact that it gives illustrations of a great variety of resort entertainments, which have become a special feature in the operation of electric railways in many cities.

A COMPREHENSIVE CATALOGUE.—A departure from the time-honored method of catalogue compilation has been initiated by A. K. Warren & Co., New York, in their new catalogue, just issued. The usual index has been dispensed with, and the items and articles are arranged in alphabetical order, which arrangement, of course, comprises an index in itself. This house handles electrical supplies of every description, from the generator to the lamp or from motors to their source of power, and the goods catalogued represent the latest and most approved designs. The catalogue is very completely illustrated and embraces everything in electric lighting and power apparatus. At the back are given several tables for ready reference which will save engineers considerable time in making calculations.

SEPARATORS.—An attractive catalogue has just been issued by Warren Webster & Co., Camden, N. J., descriptive of Webster separators for live and exhaust steam mains. The purpose of these separators is to separate and remove moisture or entrained water from live steam, and oil or grit from exhaust steam. They are applied to boilers, engines, pumps, feed-water heaters and steam-heating systems. It is stated that the steam after passing through this separator will contain less than 1 per cent. of moisture, irrespective of its quality at entrance, and the company guarantees to remove from exhaust steam such percentage of oil, that the condensation from heating systems or exhaust steam when used for a feed-water heater can be utilized as available boiler feed or for manufacturing purposes. The catalogue gives some excellent dimensional illustrations of the separator, showing its construction in every part. The illustration on the front page, of the main office and works of the company, shows the establishment to be a very extensive one.

PORCELAIN INSULATORS.—The high potential porcelain insulators on the Niagara Falls-Buffalo power transmission line have been the object of considerable attention lately, in connection with the Niagara Falls meeting of the National Electric Light Association. The excellence of the porcelain used in this class of insulators, and the care taken in their manufacture, has resulted in the upbuilding of an industry that is constantly growing in importance. One of the largest concerns engaged in the manufacture of these goods is the Imperial Porcelain Works, Trenton, N. J. The quality of its porcelain for electrical purposes stands high in the list, and its insulators are, it is stated, the only ones that stood the test at Niagara Falls. The Imperial porcelain insulators are giving universal satisfaction wherever they are used, and their selection for the Niagara Falls transmission line and their performance after installation was indeed highly gratifying and complimentary to the Imperial Works. The duty imposed upon these insulators is severe in the extreme, and the greatest of care is absolutely necessary in their manufacture to bring them up to the standard requirements. The Imperial Porcelain Works has unsurpassed facilities for the manufacture of these goods, by reason of which it is enabled to fill orders promptly for insulators of any size and in any quantity. A large stock of standard goods is always kept on hand for the prompt filling of orders, and a large force is kept constantly busy at the factory to meet the demand. For high-pressure service nothing has been found to equal well made porcelain insulators, and the rapid extension of long-distance transmission lines is bringing about a perfection in insulating devices that was not thought possible a few years ago.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York City.

CONSULT THY PURSE—And buy your tickets from Chicago via the Chicago, Milwaukee & St. Paul Railway to the following named points on June 29 and 30, and July 1, 2 and 3. Look at the figures: San Francisco, $25; Salt Lake City, $20; Denver and Pueblo, $12.50; Sioux City, $9.75; Omaha and Council Bluffs, $7.75; Kansas City, $7.50; and other points in proportion. These are very cheap rates made for these special dates. Return tickets at approximately the same rates will be sold on various dates in July and August. For further information apply to the nearest coupon ticket agent or call on or address E. F. Richardson, G. A. P. D., C., M. & St. P. R'y, New York City.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JUNE 8, 1897.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

583,991. BINDING BAND FOR ARMATURES; H. Geisenhoner, Schenectady, N. Y. App. filed Oct. 31, 1896. In a binding band for armatures, the combination of a metal strip, loops formed at the extremities of the strip by bending the ends backward and securing them to the strip, a wedge secured to the strip, and clamps engaging with the wedges for drawing the extremities of the band together.

584,009. SAFETY PLUG; T. S. McClintock, Pittsburg, Pa. App. filed Aug. 5, 1896. In combination, a safety-plug giving an outer contact and having also a groove or recess in its outer face, a conducting ring extending circumferentially about the plug to make electrical contact, and the fuse on the outside of the plug connected to the outer contact, and to the conducting-ring and located within the groove in the outer face of the plug, said plug with its outer contact and contact-ring being fitted removably to a socket to make electrical connection with contacts therein.

584,013. RAIL BOND; W. B. Potter, Schenectady, N. Y. App. filed Dec. 18, 1896. In a rail bond, the combination of roughened plates, a conductor connecting the plates, a plastic compound of good conductivity filling the roughened portion of the plates, and means for securing the plates to the rails.

UNITED STATES PATENTS ISSUED JUNE 15, 1897.

584,321. LAMP SOCKET; E. M. Bradford, Boston, Mass. App. filed Nov. 19, 1896. An electric lamp socket provided with a rigid finger or plate, connected with one of the electrodes thereof, and extending transversely across the socket, and a spring finger or plate connected at one end with the other electrode, and having its other end free, said spring finger or plate extending transversely across the lamp socket, and adapted to be moved by the insertion of a lamp by reason of the contact of said lamp wth the free-end portion thereof, and said spring finger or plate resting normally in contact with said rigid finger or plate upon the withdrawal of the lamp.

584,338. MAGNETO APPARATUS; H. H. Eldred, Brooklyn, N. Y. App. filed April 4, 1896. A magneto instrument made up of two permanent magnets whose unlike poles are opposed; a generating armature between one set of opposite poles; a bell armature between the opposite set of opposite poles, and electric connections between the coils of the armatures.

584,341. APPARATUS FOR CONTROLLING ELECTRIC MOTORS; B. A. Fiske, United States Navy. App. filed March 6, 1896. The combination, with an electric motor of an electric generator, means for varying the E. M. F. of said generator, means for reversing the current between generator and motor, and mechanism whereby said current-varying and current-reversing devices may be conjointly operated.

584,352. PARTY-LINE TELEPHONE SYSTEM; W. H. Harter, Norwalk, Ohio. App. filed Aug. 10, 1896. In a telephone party-line harmonic selector-signaling device, the combination of a normally-closed main or line circuit; an electromagnet and a vibrating reed armature at the central station, and a key for connecting the same with the line circuit; a corresponding electromagnet and reed armature at a sub-station adapted to close an independent local-battery circuit; an electromagnet in said local circuit having a contact-making armature adapted to automatically close and maintain the local-battery circuit within itself and as a shunt around or past the reed-armature contact.

584,356. ELECTRIC ARC LAMP; I. H. Hegner, Paris, France. App. filed Feb. 4, 1896. The combination, with two or more arc lamps, of a means for preventing the feeding together of the carbons of any lamp until the resistance of the lamp group has attained the desired amount, and of a means for feeding the carbons of each lamp, controlled by the resistance of its own arc.

584,382. ELECTRICAL CIRCUIT-CLOSING THERMOMETER; A. Luraschi, London, England. App. filed March 15, 1897. In electric circuit-closing thermometers, the combination of an adjustable-movable terminal completely inclosed within the thermometer-tube, a perforated cross-wire through which said movable terminal passes, said cross-wire being sealed into the sides of the thermometer-tube by fusion, and a fixed terminal always in contact with the mercury.

584,383. MECHANICAL CLIP; H. H. Luscomb, Hartford, Conn. App. filed Nov. 18, 1896. A mechanical clip, consisting of two separable body parts, each having a curved jaw and a recessed shank, and a link with a smooth, interior face loosely encircling the body parts between the recessed shanks and the jaws for holding the body parts together.

584,384. AUTOMATIC ELECTRIC SIGNAL-TRANSMITTER; A. B. Macklin, New York, N. Y. App. filed Aug. 7, 1896. The combination of separately-movable contact-devices, a fixed device permanently supplied with battery current, and having separated series of contact-points, each series adapted to engage one of said movable devices, a receiver-arm, and a contact-arm, actuated by movement of the receiver-arm, and adapted to connect the battery current with said series of contact-points.

584,393. TELEPHONE SYSTEM; F. R. McBerty, Downer's Grove, Ill. App. filed May 14, 1896. The combination, with a number of telephone circuits, including transmitting telephones, and having a common return conductor, of two or more sources of current, having different poles connected with the common return conductor, and their other poles connected with different circuits, whereby cross-talk is diminished or prevented.

584,414. APPARATUS FOR TELEPHONE SWITCHBOARDS; C. E. Scribner, Chicago, Ill. App. filed April 26, 1893. In combination, in an electric annunciator, an indicator frictionally connected with a source of mechanical power, a retaining-catch normally engaging with said indicator, controlled by an electromagnet.

584,415. TELEPHONE-LINE CIRCUIT; C. E. Scribner, Chicago, Ill. App. filed Aug. 1, 1895. The combination, with a metallic-circuit telephone-line, of a transmitting-telephone and a receiving-telephone in a bridge thereof at a sub-station, a signal-bell in a permanently-closed branch from one line conductor, a magneto-generator in a branch from the other line conductor, an annunciator at the central station connected with the line to receive current from the generator, means for applying signaling-current to the line, also at the central station to operate the signal-bell, a source of current adapted for exciting the transmitting-telephone at the central station, and means for connecting the said source of current with the line, whereby switches at the sub-station are avoided.

584,416. ELECTROMAGNET; C. E. Scribner, Chicago, Ill. App. filed Nov. 4, 1895. The combination, with an electromagnet, of a bridge of magnetic material between its poles, a coil encircling the bridge, and means for producing current in the coil, said coil being adapted to create a condition of no difference of magnetic potential between the poles of the magnet.,

584,417. TELEPHONE-CIRCUIT; C. E. Scribner, Chicago, Ill. App. filed Nov. 4, 1895. The combination, with a telephone line, of a central-supply battery in connection therewith, a bell and a storage-battery permanently connected serially in the line at the sub-station thereof, an induction-coil, a receiving-telephone in circuit with the secondary winding thereof, a transmitting-telephone in circuit with the primary winding thereof, a switch, and circuit connections controlled by the switch adapted to bring the receiving-telephone and secondary winding of the induction-coil into shunt of the bell, and the transmitting-telephone and the primary winding of the induction-coil into shunt of the battery.

584,418. SPRING JACK FOR TELEPHONE SWITCHBOARDS; C. E. Scribner, Chicago, Ill. App. filed July 20, 1896. The combination, with a strip of insulating material, having a groove therein, of a contact-strap lying in the groove, an obliquely-projecting lug formed upon one of the edges thereof, an oblique recess in the floor of the groove engaging the lug, a laterally-projecting lug formed on the contact-strap, and a portion of the insulating material engaging the said laterally-projecting lug, whereby the contact-strap is prevented from moving in the groove.

584,427. PRODUCTION OF ELECTRIC SPARKS FOR SIGNALS OR THEATRICAL EFFECTS; V. Tabulewitsch, St. Petersburg, Russia. App. filed Jan. 16, 1897. In an electric signaling apparatus, a lamp having an insulated coil secured to the base thereof, a tube having a closed bottom and open top mounted in said coil, and adapted to receive one end of an electrode and secure the same therein by means of clamps, and means for reciprocating said tube, consisting of a core of soft iron, and a spring-operated lever having a roller on its free end which is adapted to bear against the closed end of said tube, said electrode being composed of carbon and the other electrode being formed of steel, said steel electrode being provided with means to permit a slight longitudinal movement of the same when the electrodes are brought together.

584,428. FLEXIBLE CONDUIT; A. L. Tucker, Chicago, Ill. App. filed Oct. 23, 1896. In a flexible conduit, the combination with a lining composed of annular sections of a spiral winding of tape inclosing said annular sections.

584,431. ARMATURE FOR DYNAMO-ELECTRIC MACHINES; H. H. Wait, Chicago, Ill. App. filed Jan. 27, 1896. In an armature for dynamo-electric machines, the combination with an armature-core formed of annular plates or discs of laminated material sectionally disposed, of radially-extending ventilating-passage provided between the said sections, a spider whereon the said core is mounted, central portions of the periphery of which being cut away to afford communication with the said radial passages, coils wound upon the said core, and spaces provided between the said coils on the outer and inner circumferences of the armature communicating with the openings in the periphery of the spider and the ventilating-passages provided in the armature-core.

584,462. ELECTRIC-CIRCUIT PROTECTOR; A. L. Creelman, Memphis, Tenn. App. filed Aug. 11, 1892. The combination of a main telegraphic or like circuit, a series of stations or offices theron, each station or office being provided with a relay instrument, and a key included in said circuit, a local circuit at each station or office containing a battery, sounder and controlling apparatus, each controlling apparatus being adapted to shunt the main circuit around the relay and key in the same office therewith, when the main-line circuit remains open for a prolonged time.

584,463. ELECTRIC SIGNAL; A. L. Creelman, Chicago, Ill. App. filed Aug. 17, 1895. In a continuously-operating alarm or signal apparatus, the combination with a normally-open circuit, of a circuit-closer for controlling the same, a battery included in said circuit, a relay-magnet also included in the circuit, an armature for said magnet, a normally-open circuit, including said battery, an alarm or signal and said armature, and adapted to be closed by the armature when the relay-magnet is energized, and a third normally-open circuit, including the same battery, the said armature, and excluding the circuit breaker, and adapted to be closed by the armature and to remain closed when the first-named circuit is open, whereby two circuits will be established through a relay-magnet and one through the alarm apparatus, all including the same battery, when the circuit-closer is momentarily closed, and whereby one only of the circuits through the relay-magnet will be open.

584,464. TELEGRAPH-SOUNDER; A. L. Creelman, Chicago, Ill. App. filed Sept. 3, 1895. The combination of an electric circuit, a sounder-magnet located therein, a branch circuit, a bell-magnet located therein, and electrically-operated apparatus in circuit with the sounder-magnet adapted to open the branch circuit when the sounder is active, and to close the same when the sounder-magnet is de-energized.

584,465. CIRCUIT-PROTECTING SOUNDER; A. L. Creelman, Chicago, Ill. App. filed May 18, 1896. The combination of a main-line circuit, a key and sounder therein, a normally-open circuit adapted when closed to shunt the instruments, a circuit-controller for closing and opening said circuit, a mechanism for operating the circuit-controller to open the circuit, an electrically-operated device included in the main-line circuit for operatively connecting the circuit-controller with one of its mechanisms when the main-line circuit is interrupted for a predetermined time, and means for operatively connecting the circuit-controller with its other operating mechanism when the main-line circuit is closed.

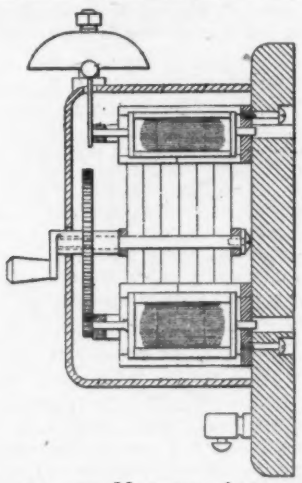
584,466. TELEGRAPHIC-SOUNDER; A. L. Creelman, Chicago, Ill. App. filed July 3, 1896. The combination of an electric circuit, a sounder-magnet and a retarder-magnet forming a part thereof, a second circuit, containing a circuit-changing magnet, a contact carried by the armature lever of the retarding-magnet for shunting the current from the first circuit through the second.

584,474. PRIMARY CELL; I. Kitsee, Philadelphia, Pa. App. filed Sept. 15, 1896. A positive element, consisting of a containing cup of a material designed to remain inert, a conducting-rod passing through the cup and a solid body of an alloy or mercury, and a metal, as zinc, cast so as to fill the space between said cup and rod, the surface of said body only being exposed.

584,476. INSULATOR; S. H. Libby, Schenectady, N. Y. App. filed Feb. 10, 1897. In a conductor-rail insulator, the combination of a metal base, a body of insulating material mounted upon the base, a rail clamp secured to the conductor-rail and prevented from moving independently of the insulator by frictional engagement therewith.

584,477. INSULATOR; S. H. Libby, Schenectady, N. Y. App. filed Feb. 10, 1897. The combination of a conductor-rail, a body of insulating material situated each side of and supporting the rail, and a support for each body of insulating material permitting a limited amount of vertical movement of the conductor-rail.

584,482. SYSTEM OF DISTRIBUTION; E. W. Rice, Jr., Schenectady, N. Y. App. filed Feb. 7, 1896. The method of maintaining potential upon a two-wire system of distribution, connected with a three-wire system, which



No. 584,338.—Magneto Apparatus.

consists in supplying the two-wire system with energy from both sides of the three-wire system.

584,511. ELECTRIC RAILWAY; T. W. Kloman, Montclair, N. J. App. filed April 30, 1896. In an electric railway, a continuous-stationary rail attached to one side of a slitted conduit; a series of sectional rails or conductors provided with curved ends, said rails or conductors being pivotally supported by the opposite side of the conduit and in the same plane with said stationary rail, and provided with means for connecting movable contacts with fixed contacts attached to a current feeder or main, in combination with a rigidly-supported, two-part, cup-shaped trolley, one part of which is adapted to bear continuously against the stationary rail, the other part being adapted to yieldingly lift the sectional rails in such manner as to operatively connect the current feeder or main through circuit connections and a propelling-motor carried by a car, said sectional rails being provided with means for restoring them to normal position by gravity after the trolley has passed from beneath them.

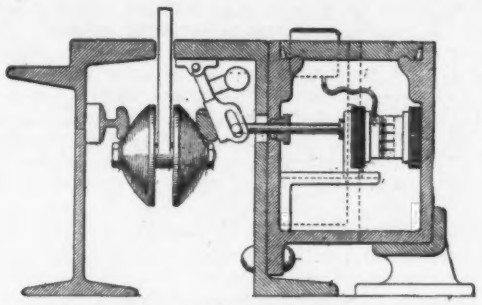
584,577. REGULATING SPEED OF INDUCTION MOTORS; E. Danielson, Stockholm, Sweden. App. filed May 2, 1897. In combination, a number of induction motors mechanically connected together, said motors having different numbers of poles, and means for operating them singly or in tandem groups.

584,606. TROLLEY-STAND; S. H. Short, Cleveland, Ohio. App. filed Feb. 16, 1897. The combination of a base, having a slot, a trolley-arm support pivoted to the base on a vertical axis, a trolley-arm pivoted to the support on a horizontal axis, and a finger rigid with said arm and extended below its axis, and adapted to enter said slot when the trolley-arm is in service, but to be withdrawn therefrom when said arm is drawn down.

584,607. TROLLEY-STAND; S. H. Short, Cleveland, Ohio. App. filed Feb. 16, 1897. The combination of a base, having two slots at diametrically-opposite points, and a trolley-arm support pivoted to the base on a vertical axis between said slots, with a latch-lever pivoted to said support, and adapted to engage in either slot, and a trolley-arm pivoted to the support and having a finger adapted to engage said latch and swing it out of engagement with said slots when the trolley-arm is drawn down, and means exerting a constant force to swing the trolley-arm upward.

584,618. TELEPHONE-TRANSMITTER; F. C. Alexander, Bonham, Tex. App. filed Feb. 27, 1897. A telephone-transmitter, comprising a diaphragm and shell formed from one piece of metal, a block of insulating material to which the diaphragm is secured, a carbon block attached to said metal plate, secured to the block of insulating material, a vibrating nipple on the diaphragm extended into a cell formed in said carbon block, and an electrode of granulated material surrounding the nipple in the cell.

584,632. LIGHTNING ARRESTER AND MULTIPLE-AUTOMATIC FUSE BLOCK; G. X. Gast, New Orleans, La. App. filed April 10, 1897. In a lightning arrester and multiple-automatic fuse block, the combination with a series of fusible strips, a swinging-arm making connection through the fusible strips successively; of a resistance and an automatic switch placed to throw the current through the resistance during the passage of the swinging-arm from the melted fusible strip to the next fusible strip.



No. 584,511.—Electric Railway.

584,639. ELECTRIC RAILWAY; H. M. Jones, Meriden, Conn. App. filed Aug. 12, 1896. In an electric railway, a conduit having a longitudinal slot at its top, and a tubular cable for normally closing said slot, the cable consisting of a spiral coil, the spirals being arranged close together, yet adapted to open or stretch at points lifted from the slot.

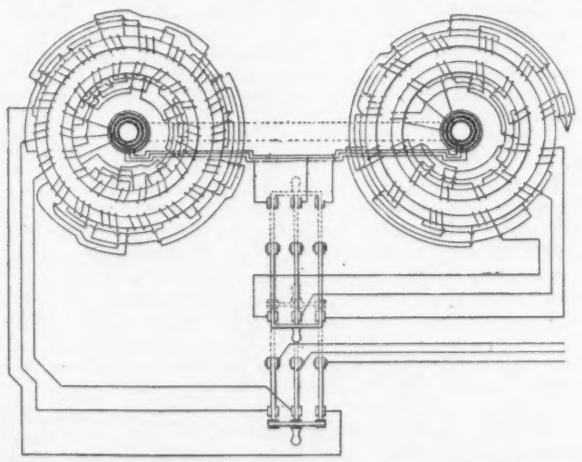
584,644. BOND FOR ELECTRIC RAILWAYS; F. T. Newbery, San Francisco, Cal. App. filed Aug. 25, 1894. The combination with railway rails, whose abutting ends are provided with coincident holes, a bond or dowel compressed into said holes so as to be intimately bound therein for the purpose of holding the rails together and making a continuous electrical conductor.

584,649. SECONDARY-BATTERY PLATE AND METHOD OF PRODUCING SAME; W. P. Patton, Jersey City, N. J. App. filed Feb. 15, 1897. A secondary-battery plate comprising a sheet-metal partition coated with soluble inert material on each side, and having openings along the edges and cast-metal perforated sides, which are integrally united through the openings in the partition.

584,694. INCREASING ILLUMINATING POWER OF ELECTRIC-ARC LAMPS; P. Mersch, Paris, France. App. filed April 14, 1897. As a new article of manufacture, a composition for increasing the illuminating power of electric-arc lights, consisting of an admixture of carbonate of magnesia, asbestos, or some other incombustible textile product, and silicate of potash.

584,700. ELECTRICAL-ADVERTISING ANNUNCIATOR FOR CARS; J. P. Orr & G. H. Fugh, Pittsburg, Pa. App. filed Sept. 29. 1896. In an electrical-advertising annunciator, the combination of a cylinder having leaves or cards, a controlling belt having teeth to engage said cards with a crank-shaft, having thereon pulleys to operate said belt and cylinder, a worm-wheel having a clutch connection with said shaft, and an operating motor and motor-circuit, including one automatic-circuit opener, having a circuit-closer operated by a bell cord and a bell-clapper pinion.

584,722. PERFORATOR FOR ELECTRIC TELEGRAPHS; C. G. Burke, Brooklyn, N. Y. App. filed Sept. 4, 1896. The combination in a perforating



No. 584,577.—Regulating Speed of Induction Motors.

apparatus for automatic telegraphy, of a paper punch and feed mechanism for the paper and a ratchet connected with the feed mechanism, a lever and pawl engaging with the ratchet, a series of keys, all of which, when depressed, operate the punch and the feed mechanism, and a series of bars of varying widths connected with the keys and adapted to be interposed by the depression of the latter in the path of the lever of the feed mechanism, whereby the extent of play or angular movement of said lever will be different for different keys.

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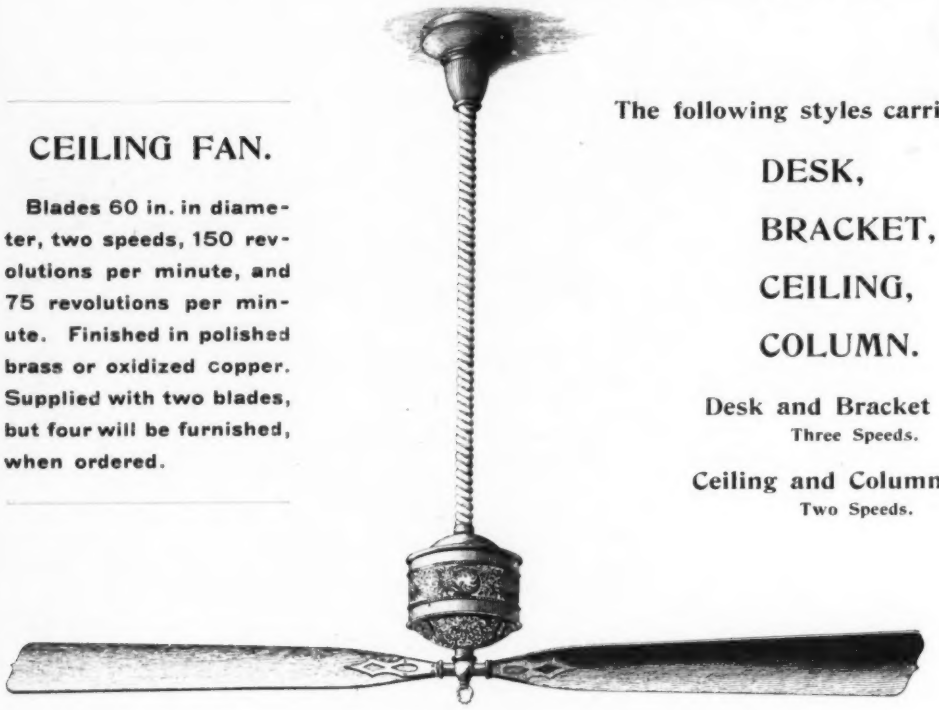

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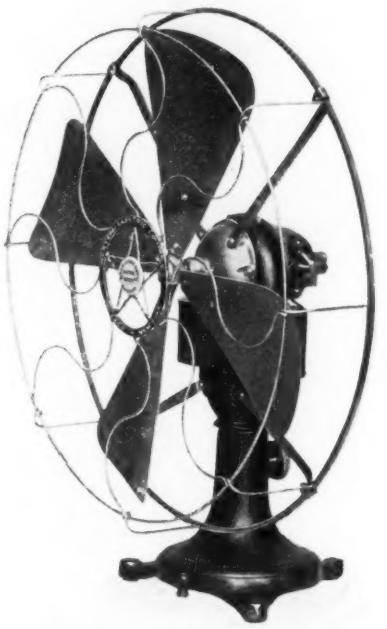

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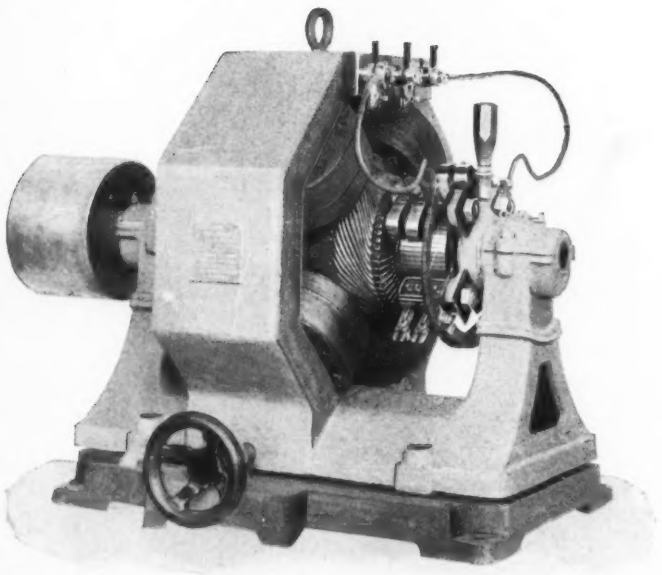

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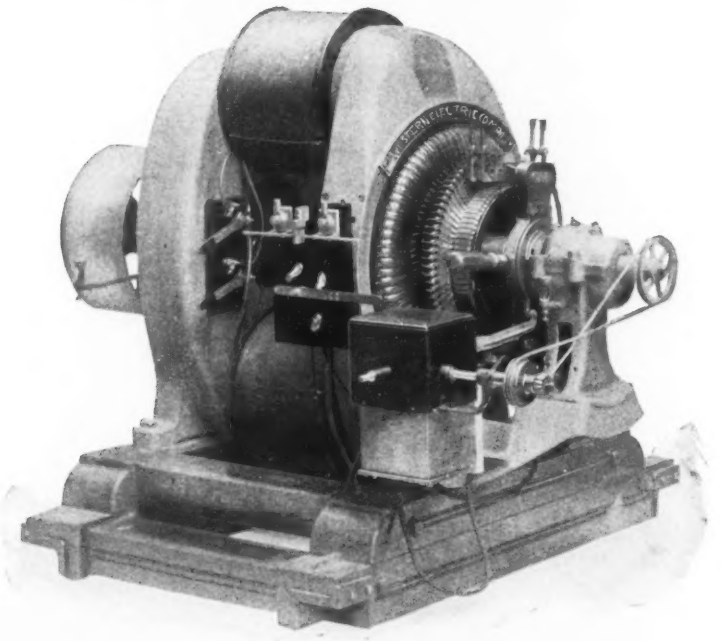

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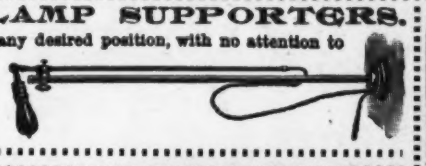

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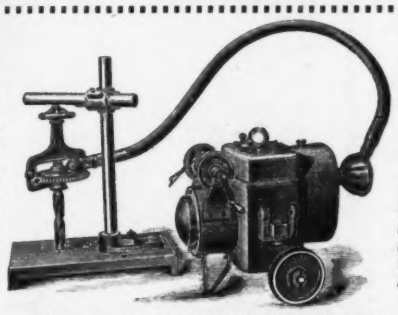

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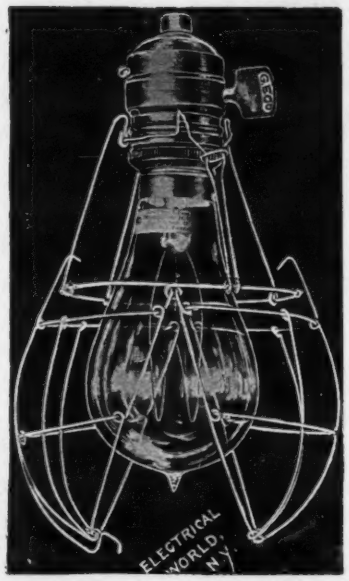

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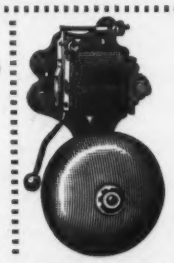

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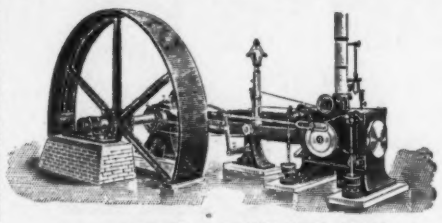

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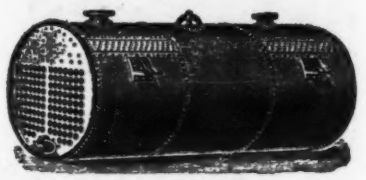

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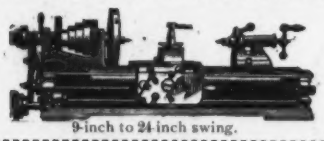

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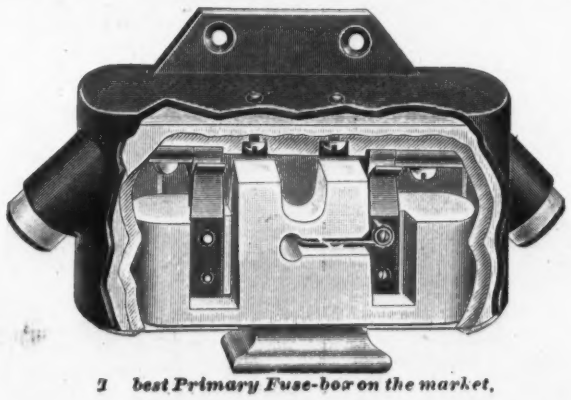

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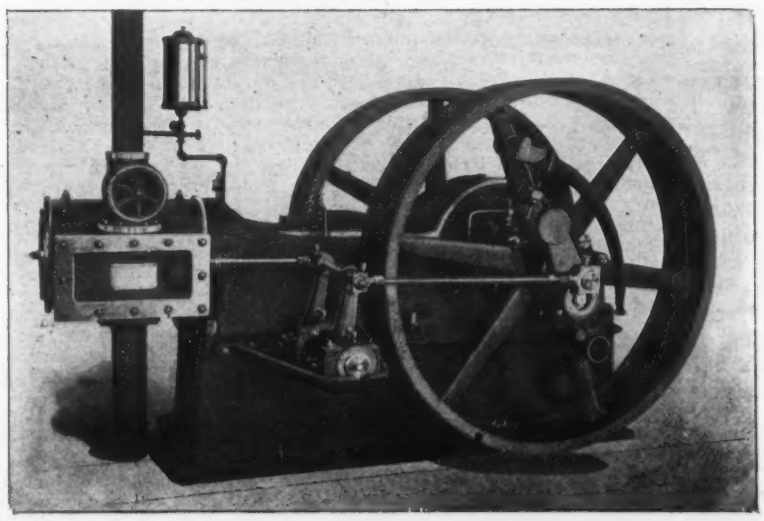

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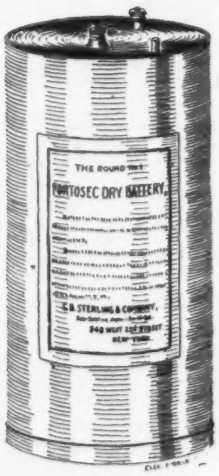

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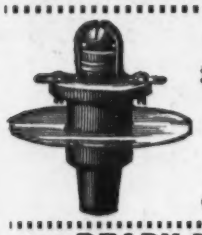

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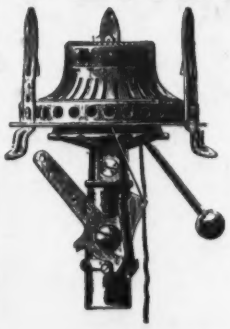

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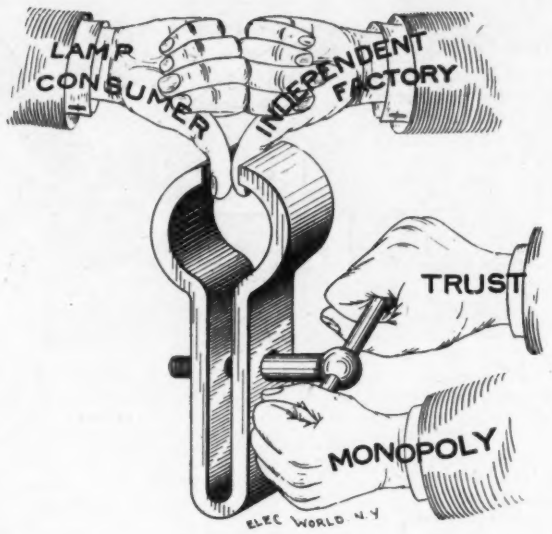

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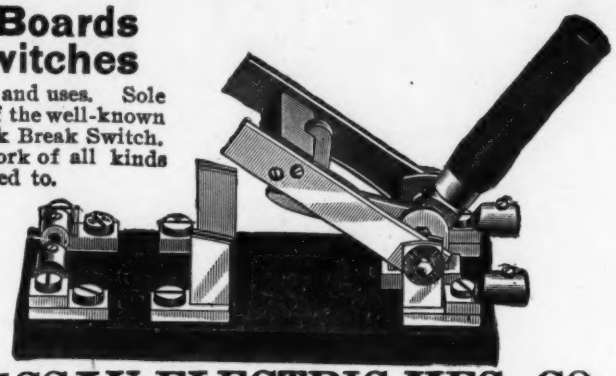

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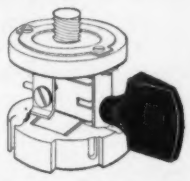

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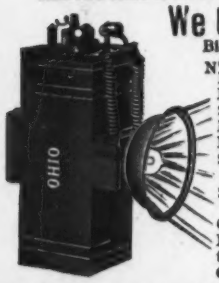

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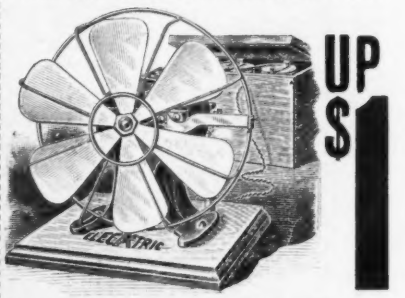

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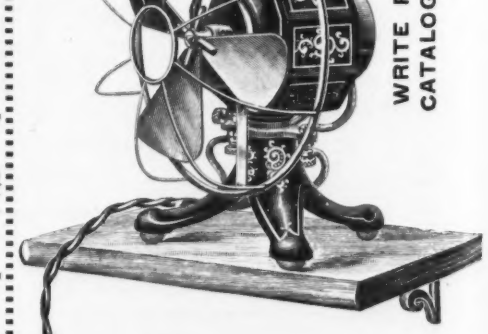

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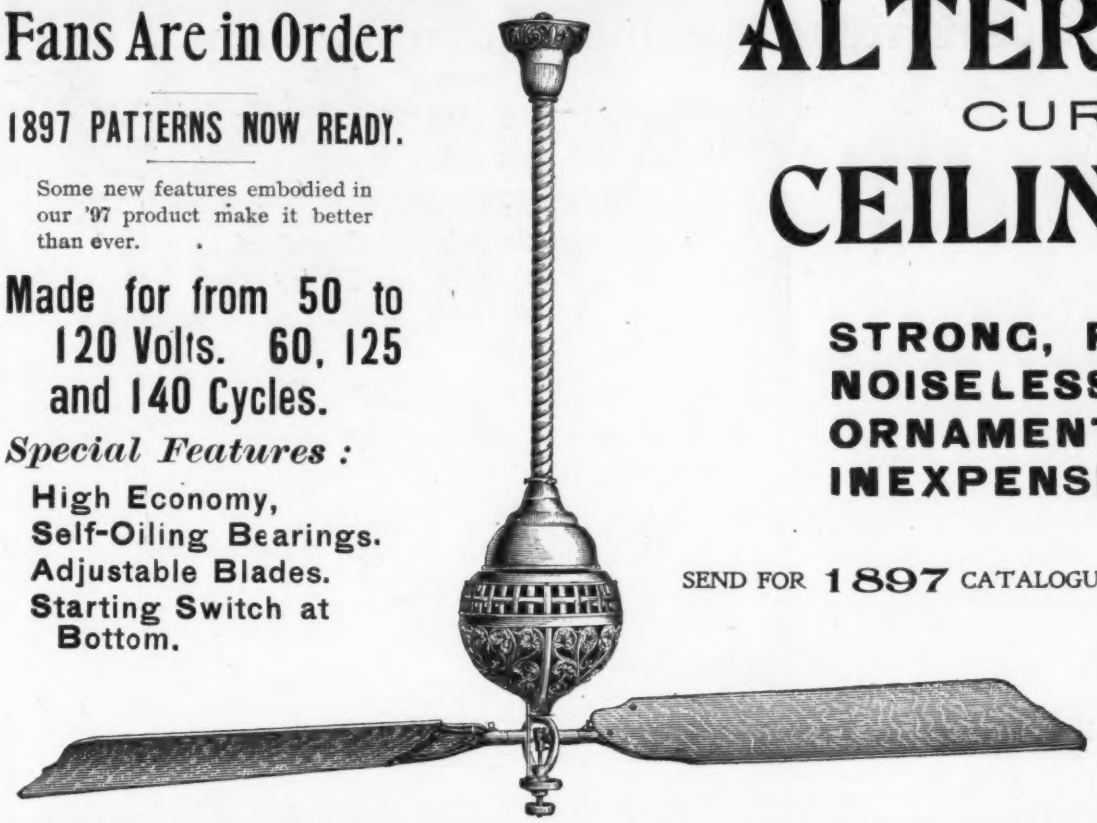

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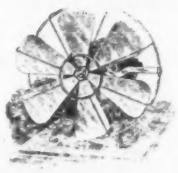

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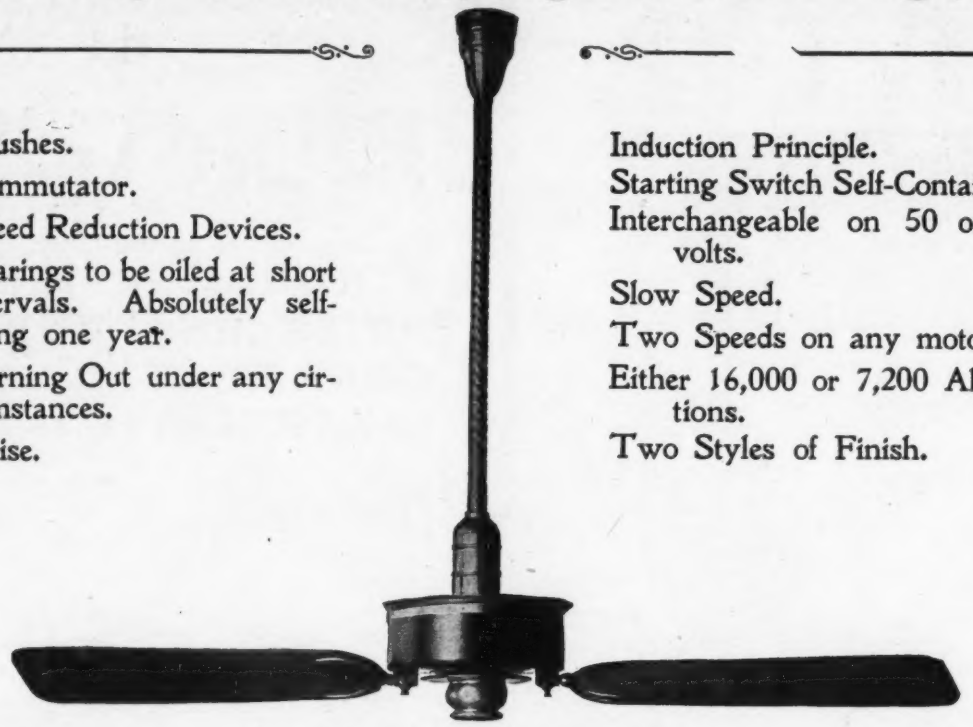

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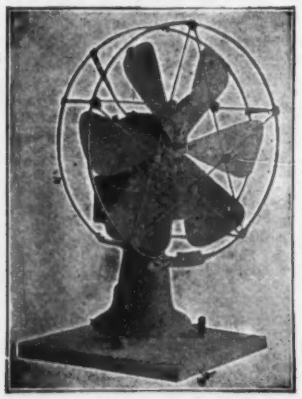

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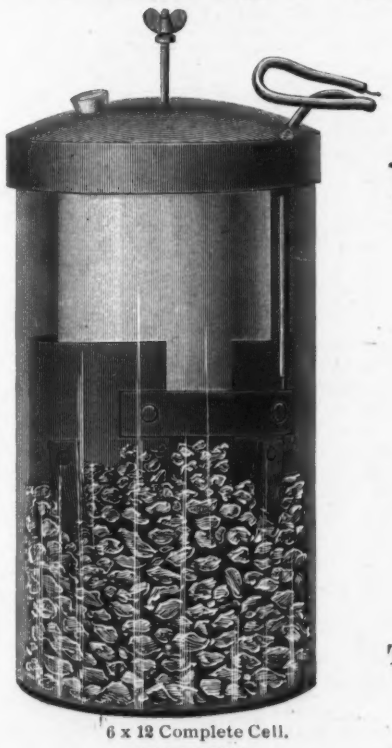

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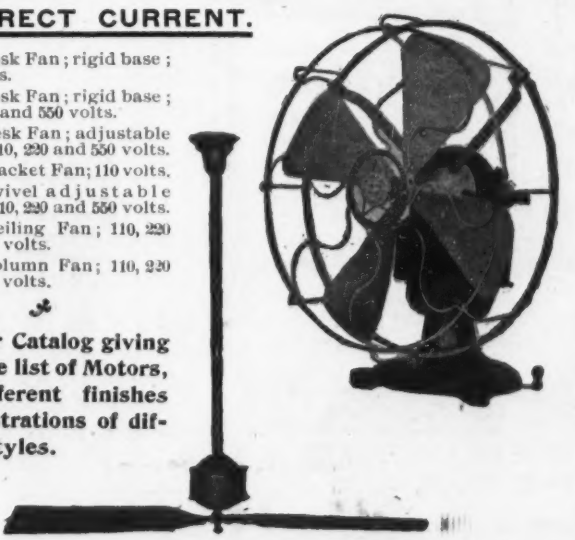

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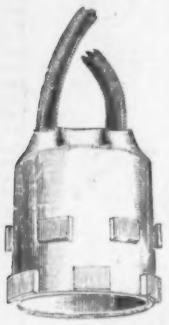

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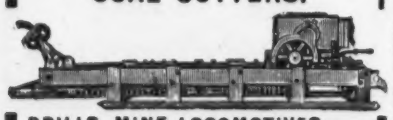

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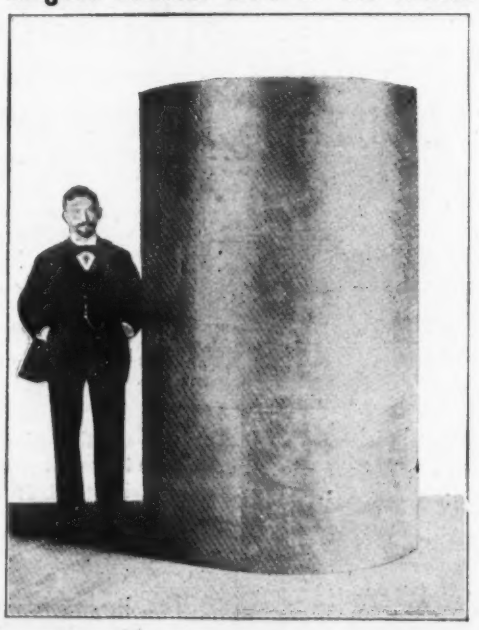

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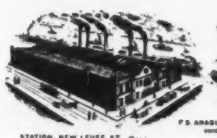

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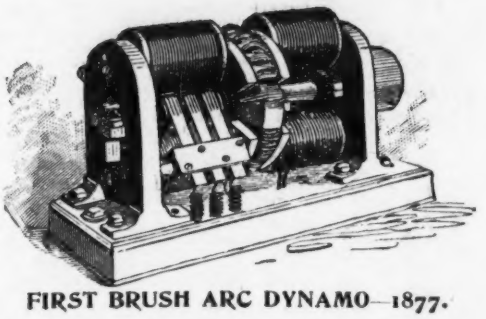

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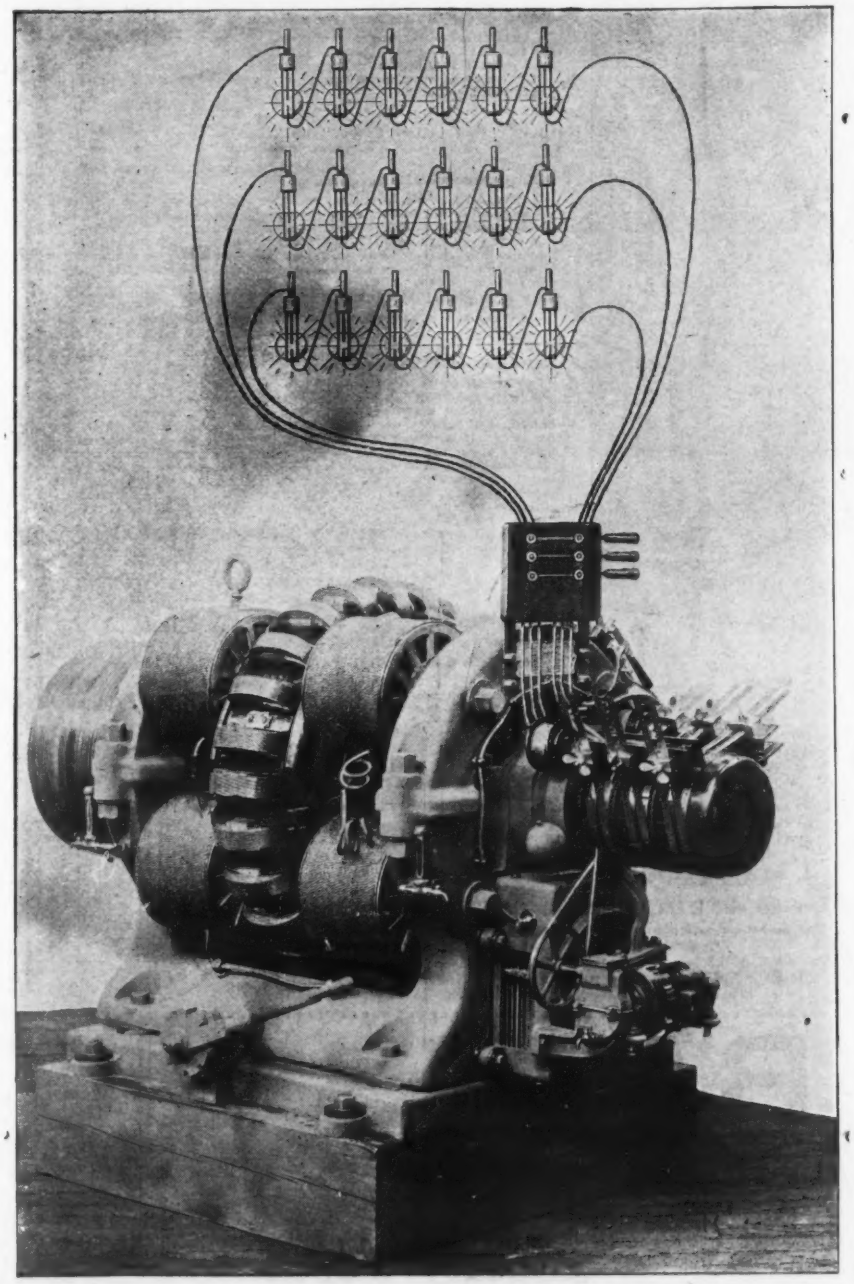

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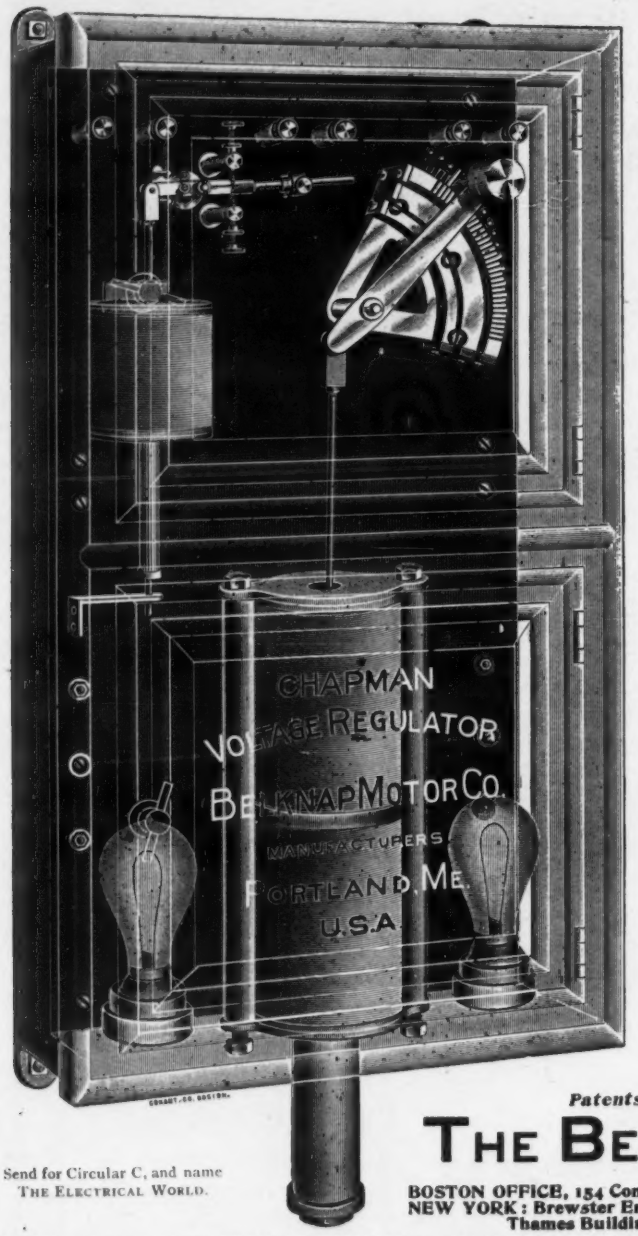

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What the KENSINGTON ELECTRIC LIGHT CO., of Philadelphia, Pa., says:

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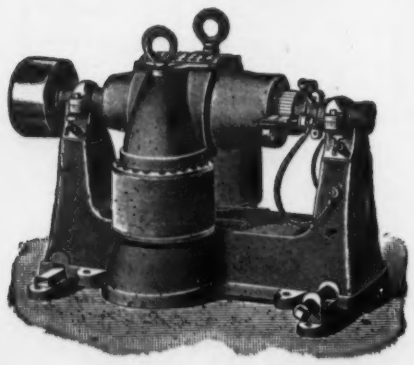

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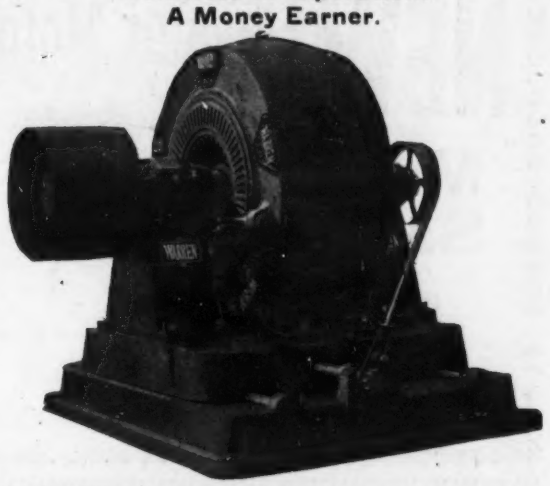

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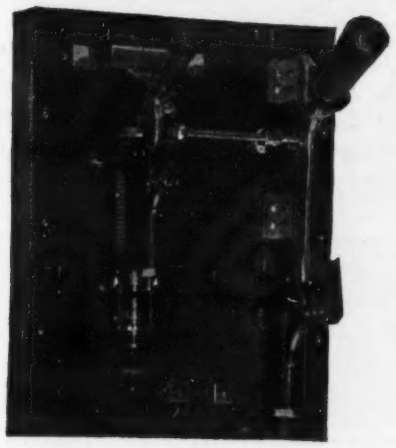

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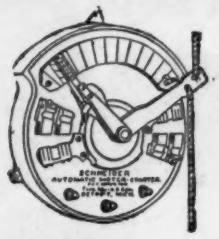

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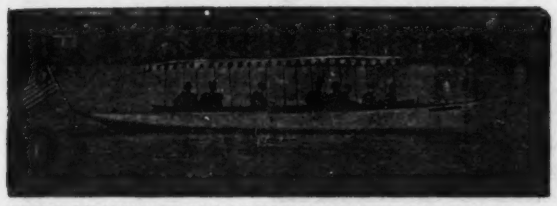

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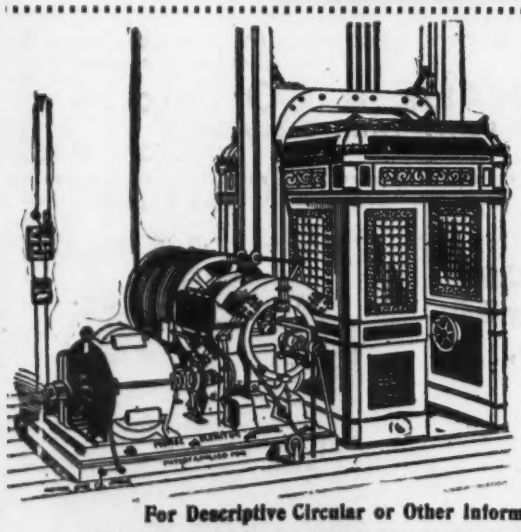

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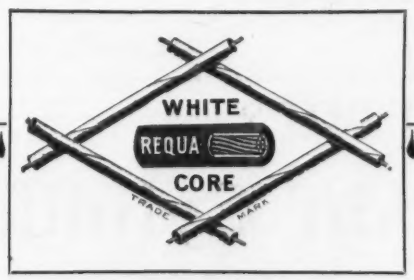

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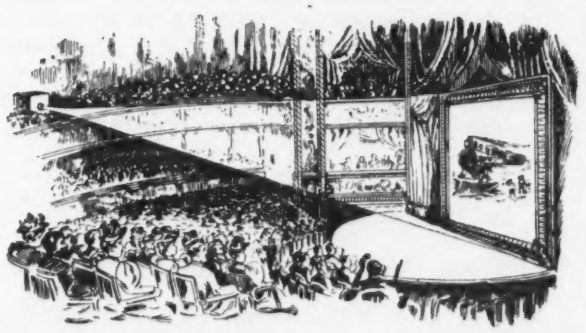

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CONTENTS.

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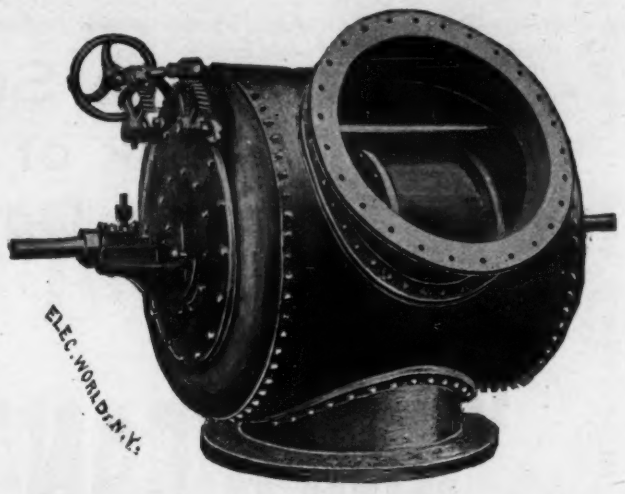

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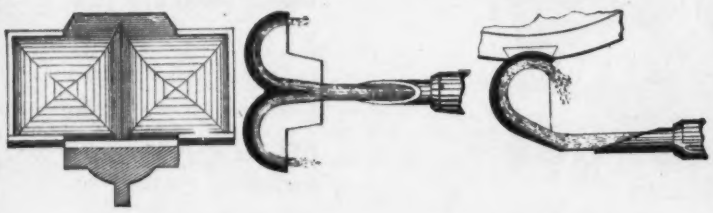

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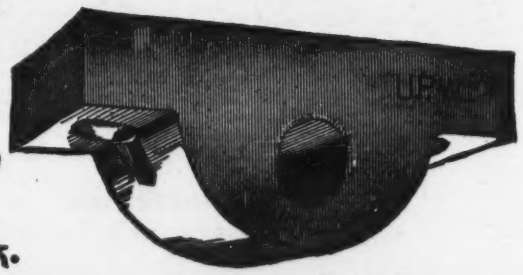

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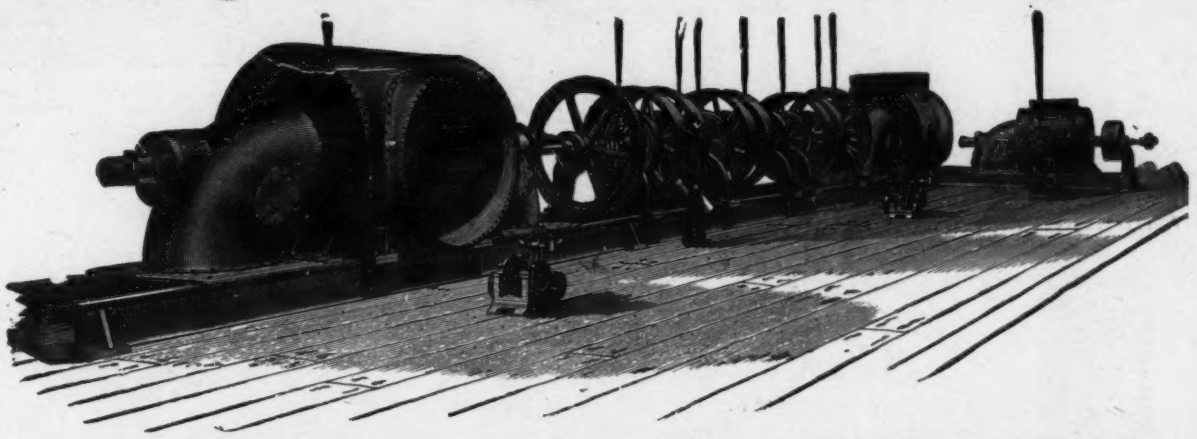

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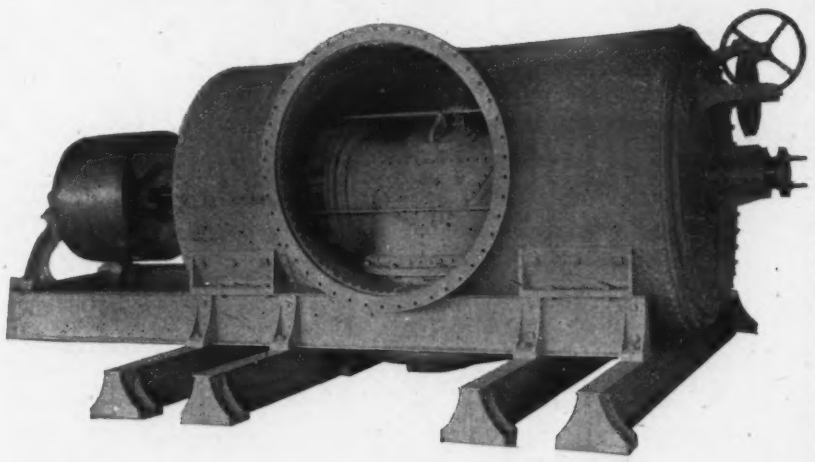

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Full	15.00	144.00	172.69	240.97	82.03	Full	15.29	194 25	102.02	143.44	81.08
⅞	15.04	138.12	155 03	223.61	84 55	⅞	16.56	187.75	92.15	146.73	84.78
¾	15.11	127.67	133.24	191.06	83.68	¾	17.33	178.50	83.95	138.40	83.88
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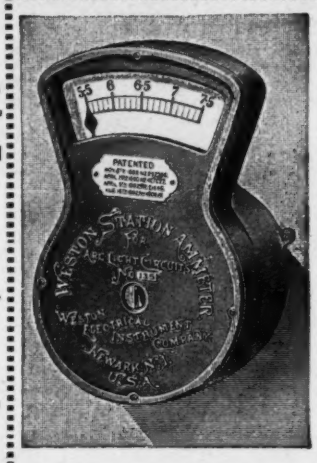

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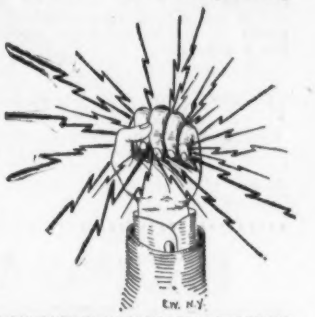

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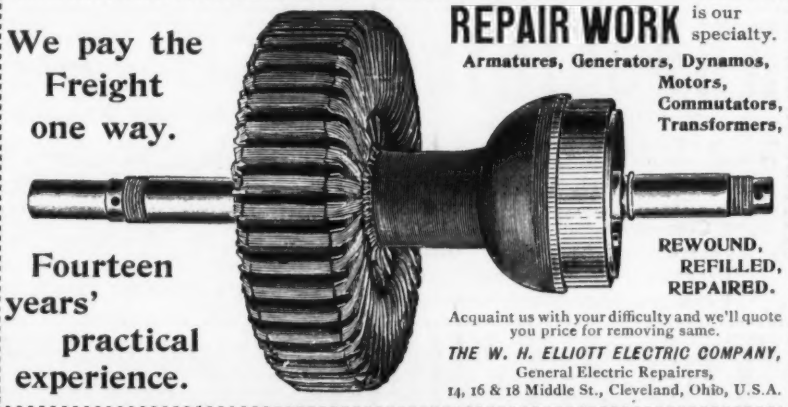

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Acquaint us with your difficulty and we'll quote you price for removing same.

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Bids for Electric Street Lighting of the City of Olney.

The City of Olney, Illinois, will receive bids up to 4 o'clock p. m. on July 5th, 1897.

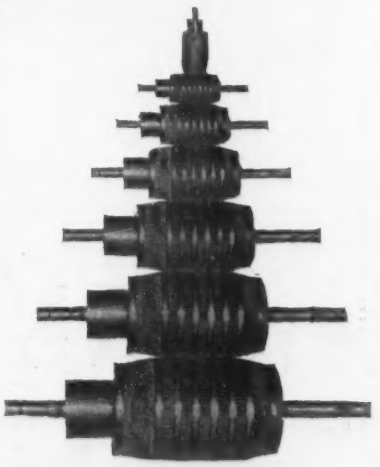
First—For street lighting by electric lights for a period of ten years, also a franchise for the erecting, maintaining and operating of an Electric Light, Heat and Power Plant for the same period.

Second—Bids for street lighting by electric lights for a term of ten years from the date said lights are started, and also for a twenty years' franchise for erecting, maintaining and operating of an electric light plant; said plant to operate within the present and future limits of the City of Olney, Illinois.

The City of Olney reserves the right to reject any and all bids.

Dated Olney, Illinois, June 7, A. D. 1897.

J. H. Senseman, Mayor.
J. H. White, City Clerk.



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7000 1¼-in. Locust Pins.
5000 Painted Oak Brackets.
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Will close above out at a bargain if taken at once. Address,

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The following described second-hand electrical machinery and appliances in good order we offer for sale and are prepared to make prices which will, we believe, be found attractive:

One D-62 500-volt T.-H. Generator.
One 20 K. W. 125-volt Edison Generator.
Two 250-light 70-volt U. S Generators.
Two 40-light arc U. S. Generators.
One 20-light arc U. S. Generator.
100 single carbon U. S. arc lamps.
One 10 H. P. 220-volt Detroit Motor.
One 2 H. P. 10-ampere Baxter Arc Motor
One 1200 ampere 500-volt Thomson recording wattmeter.
One 25-light 70-volt Thomson recording wattmeter.

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		Price Each.
4	G. E. 800 Motors	$185 00
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23	" No. 3, 25-h.p.	150 00
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One 120-K. W. 1,000-volt T.-H., toothed armature, exciter and instruments.
One 60-K. W. 1,000-volt T.-H., toothed armature, exciter and instruments.
One A 35 650-light, 1,000-volt T.-H., with exciter and instruments.
One 75-K. W. 2-phase, 2,000-volt Westinghouse, exciter and instruments; practically new.
One 30-K. W. 1,000-volt Westinghouse, toothed armature, with exciter.
Two 750-light, 1,000-volt Westinghouse, complete; very cheap.

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Two D 80 T.-H. compound wound dynamos, practically new; extremely low price.
One M. P. 100-K. W. Westinghouse.
Two 100-K. W. Edison.
Two 60-K. W. Edison.
Two 45 " "
Two 30 " "
Two 15 " "
Two 8½ " "
One 400-light Westinghouse.
One 250 " "
Two 60-amp. " compound Letter type, brand new.
One D 3-K. W. T.-H

ARC DYNAMOS.

Two 65-light, No. 8, 10-amp. Brush.
Two 50-light, M. D. 10-amp. T.-H., ring armature.
Two L. D. 12, 50-light, 1,200-c. p. T.-H.
One 35-light L. D. 2 T.-H., ring armature.
One No. 8 75-light 1,200-c. p. Wood.
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We have on hand a large stock of T.-H. and Brush arc lamps, double and single, 2,000 and 1,200 c. p. All have been thoroughly overhauled, and are offered at extremely low prices.

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One 15-h. p., 500-volt C & C.
One D 40 220-volt T.-H.
One 20-h. p., 220-volt Edison
One 6-h. p., 220-volt Jenney.
One 3-h. p., 220-volt Jenney.
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One 1-h. p., 220-volt C & C.
One 3-h. p., 220-volt Sprague.
One ¼-K. W. 110-volt Edison.

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We have on hand a large stock of Stanley and T.-H. type F converters, 1,000 volts primary, 50 or 100 secondary which we are selling at a very reasonable price. They are practically new, and were replaced immediately after being purchased, for the reason that it was necessary to adopt 2,000 volts. They have all been put through the factory.

Write for our List of these Transformers.

Every machine guaranteed to be in absolutely first-class condition.

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For Sale—Stationary Motors.

110 Volt.

1	⅛	H. P.	Crocker-Wheeler.
10	⅛	"	Sprague.
1	¼	"	Lundell.
1	¼	"	Roth & Eck.
1	½	"	Edison.
1	½	"	Hawkeye.
1	1	"	Edison.
1	1	"	Wood.
1	3	"	Thomson-Houston.
1	3	"	Hornellsville.
2	4	"	Westinghouse.
1	4	"	Edison.
1	5	"	Eddy.
1	5	"	Westinghouse.
2	7½	"	Edison.
2	10	"	"
1	15	"	Thomson-Houston.
1	15	"	Westinghouse.
3	20	"	Edison.
2	25	"	"
1	25	"	Thomson-Houston.
1	30	"	Edison.
1	35	"	"
1	60	"	"
1	75	"	"

220 Volt.

1	½	H. P.	Edison.
1	¾	"	Sprague.
1	½	"	"
3	½	"	Edison.
1	½	"	Crocker-Wheeler.
1	1	"	Rockford.
1	1	"	Thomson-Houston.
1	1	"	Crocker-Wheeler.
2	1	"	C & C.
1	1½	"	Baxter.
1	2	"	C & C.
1	2	"	Edison.
1	2	"	La Roche.
2	2	"	Eddy.
1	3	"	"
1	3	"	Bain.
1	3	"	C & C.
1	3	"	Edison.
2	5	"	Thomson-Houston.
1	5	"	C & C.
1	5	"	Crocker-Wheeler.
1	7½	"	Mather.
3	7½	"	Edison.
1	10	"	Eddy.
1	10	"	Edison.
1	10	"	Mather.
1	15	"	Edison.
2	20	"	H. P. Edison.
1	25	"	"
1	25	"	Thomson-Houston.
1	50	"	C & C.

500 Volt.

1	1	H. P.	Crocker-Wheeler.
6	1	"	Eddy.
1	2	"	"
1	2	"	Hawkeye.
1	2	"	Commercial.
1	3	"	Thomson-Houston
1	3	"	Crocker-Wheeler.
1	3	"	Detroit.
1	5	"	"
1	5	"	D. & D.
1	7½	"	Thomson-Houston.
1	7½	"	Commercial.
1	7½	"	Edison.
1	10	"	Kester.
1	10	"	Edison.
2	15	"	Mather.
1	15	"	Westinghouse.
2	15	"	Edison.
1	20	"	"
1	30	"	Eddy.
1	35	"	Jenney.
1	50	"	"
1	75	"	Edison.

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14 in. x 6 ft. Putnam, R. and F. rest. Has two chucks.
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A lot of Thompson Speed Lathes with slide rests.
Two American Tool and Machine Co.'s Fox lathes.
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Two heavy pattern Pratt & Whitney Gang Drills with chucks.
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One Barnes Friction Disc Drill.
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37 in. x 36 in. x 8 ft. Pease Planer with attachment for boring.
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24 in. x 24 in. x 6 ft. Putnam Machine Co. Planer with angle plates.
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20 in. x 18 in. x 3 ft. New Haven Planer with chuck.
No. 2 Garvin Semi-Universal Milling Machine, complete.
No. 1 Garvin Power Miller, complete.
No. 3 Garvin Hand Miller, complete.
No. 1 Garvin Hand Miller.
No. 1 Pratt & Whitney Hand Miller.
No. 5 Garvin Power Miller, back geared.
No. 3 Garvin Lincoln Pattern Miller, heavy pattern.
15 Friction Drop Hammers, all makes and sizes, from 200 to 1,000 lbs.

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One 900-Light Westinghouse Alternator.
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One 300 " " " " with newly wound Armature and new Commutator.
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15 "	220-volt Eddy, - - -	200.00
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20 "	220-volt Sprague, - -	225.00

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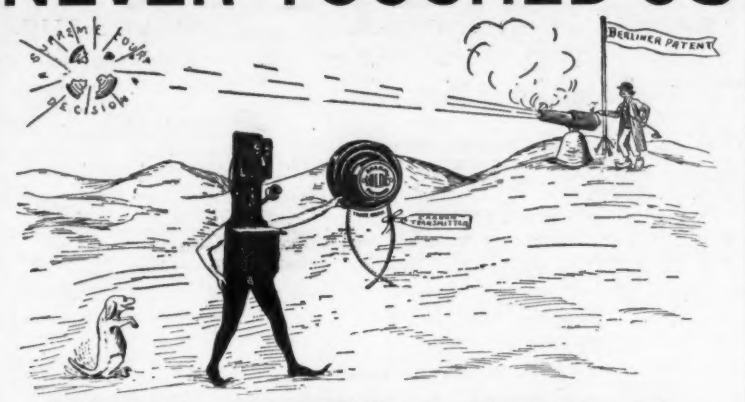

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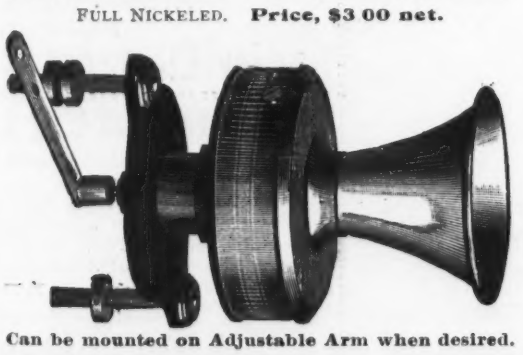

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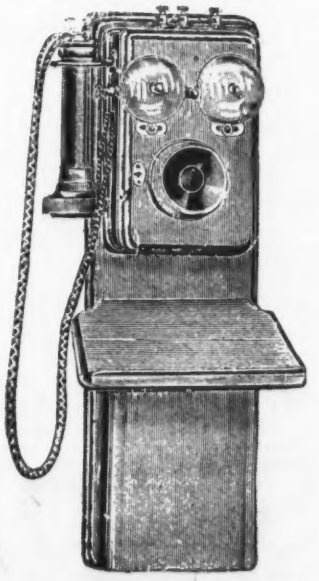

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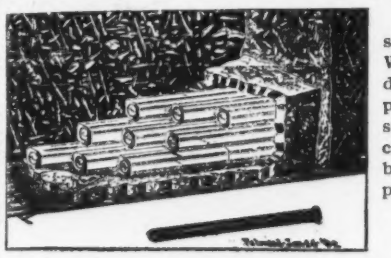

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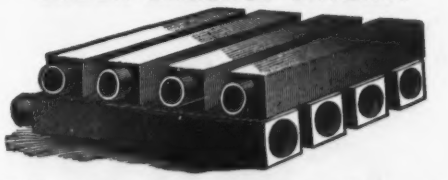

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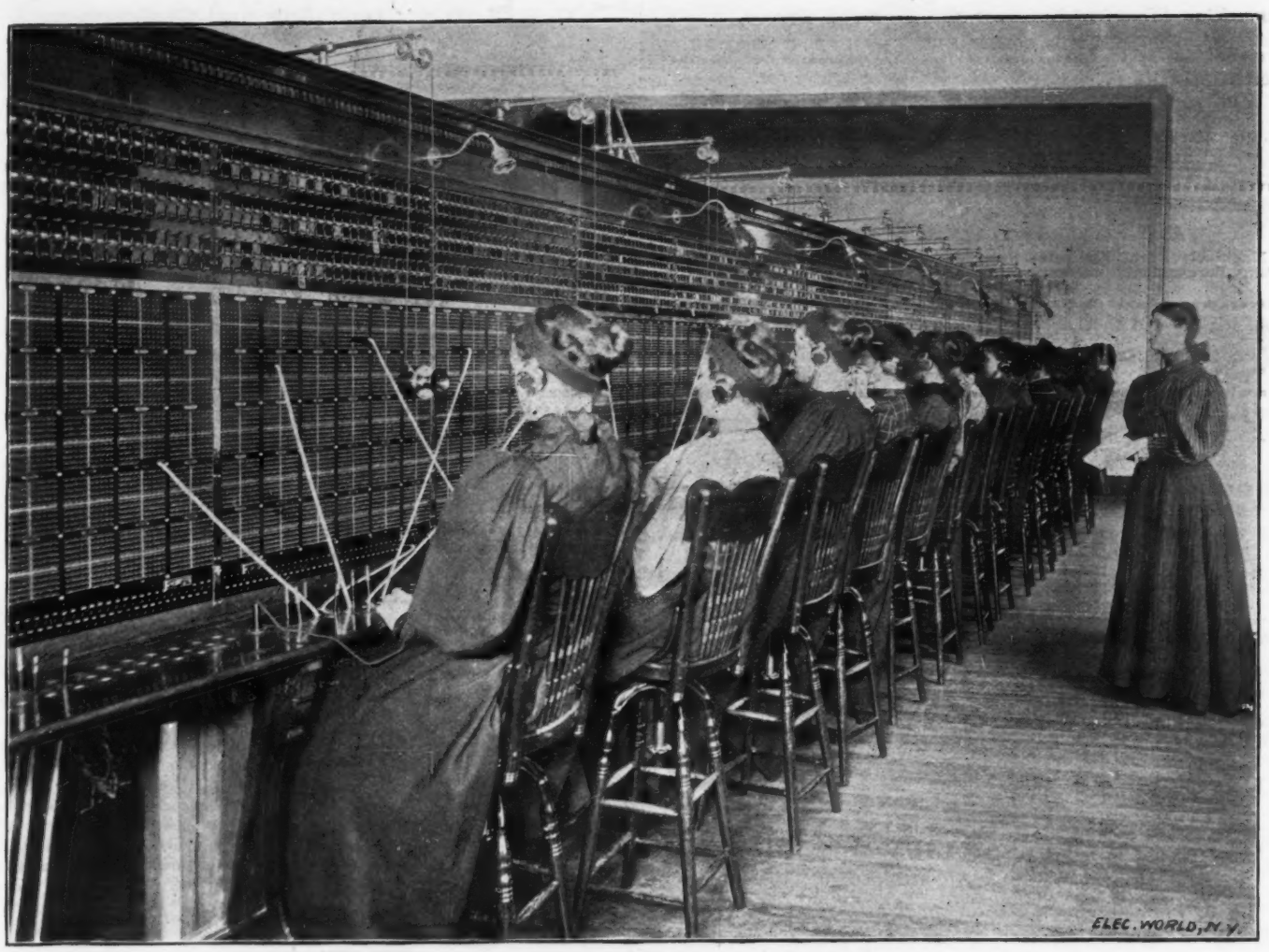

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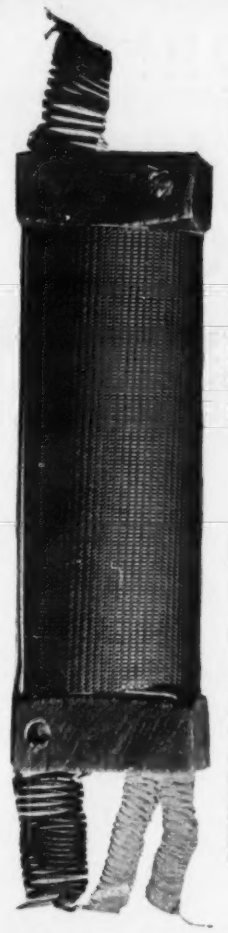

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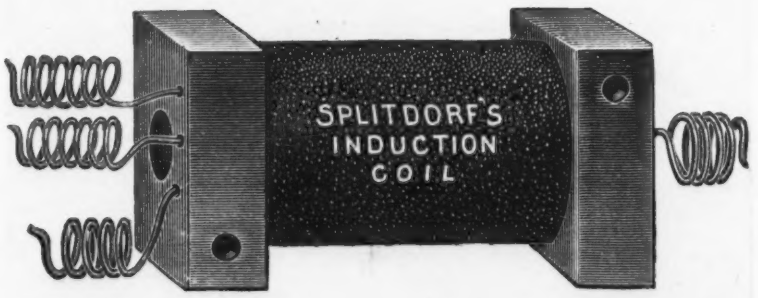

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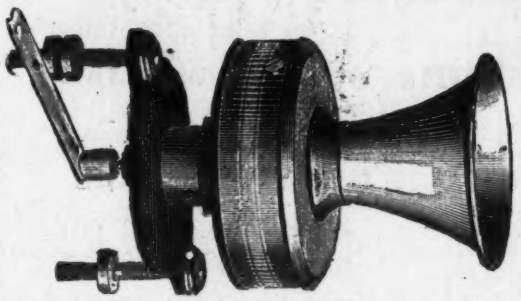

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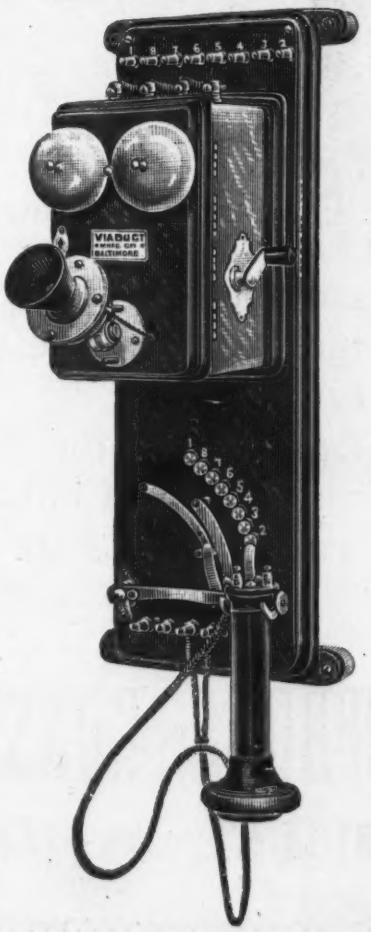

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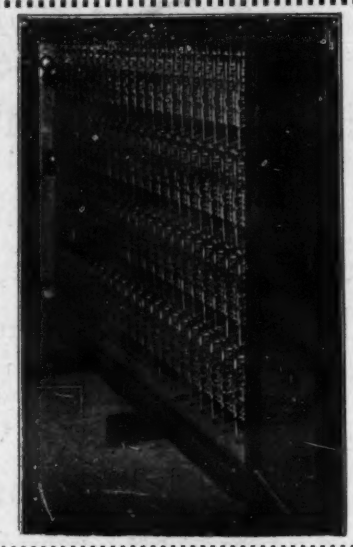

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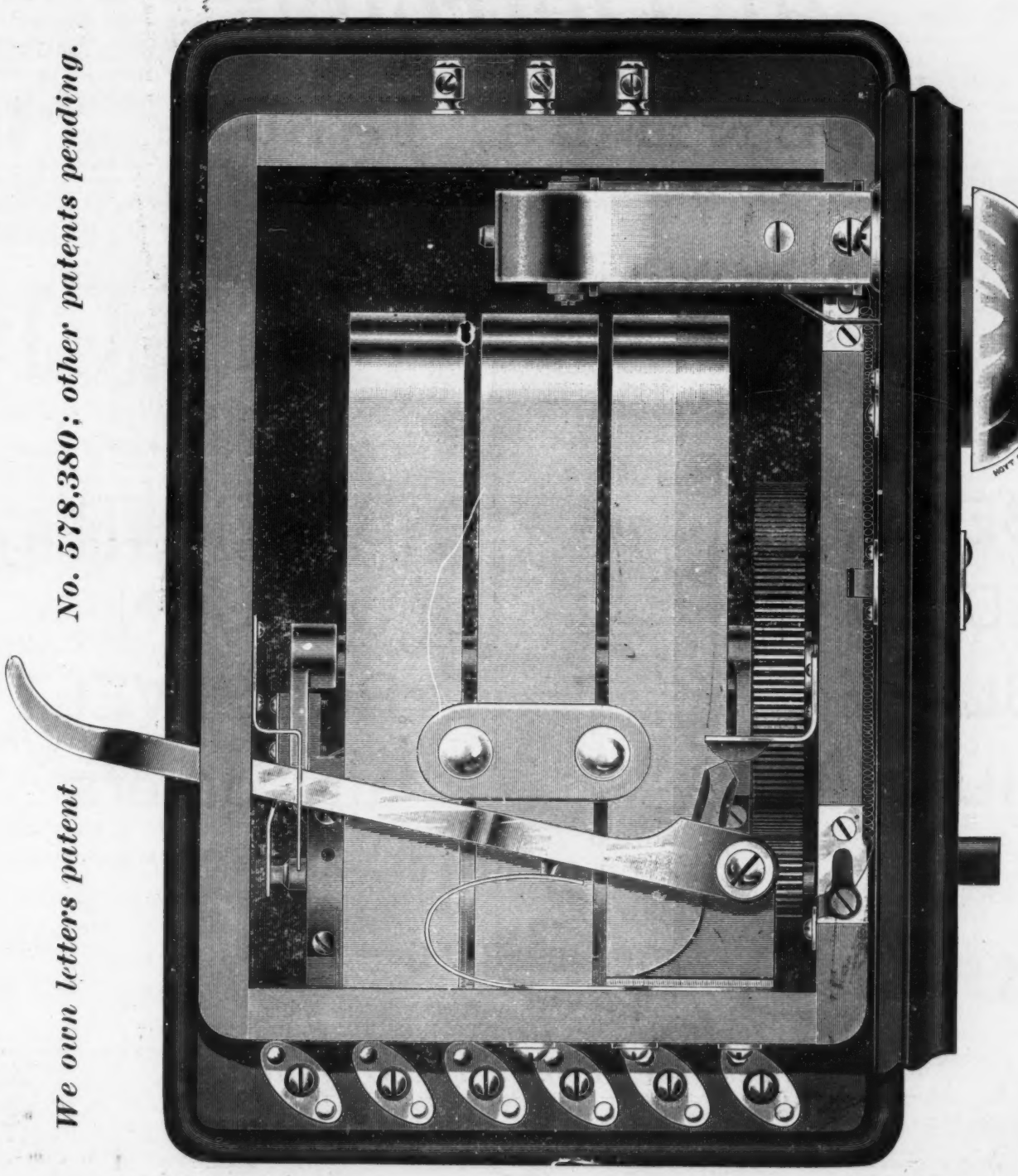

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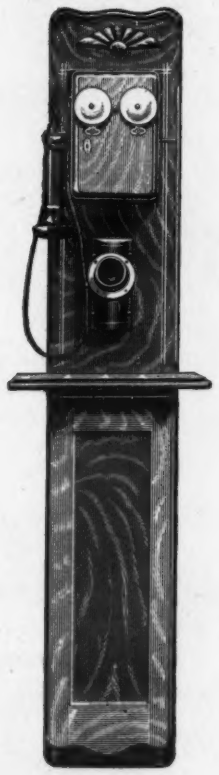

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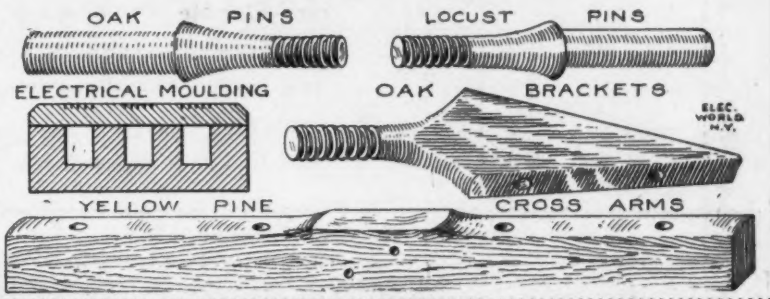

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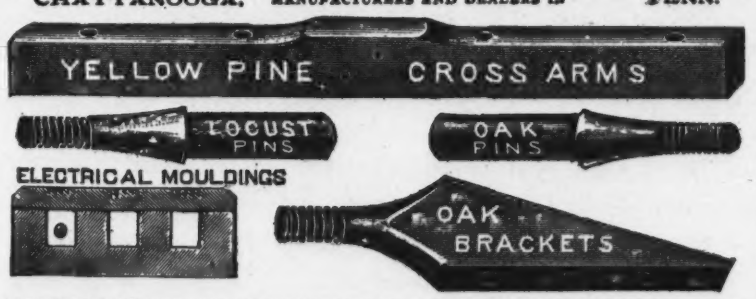

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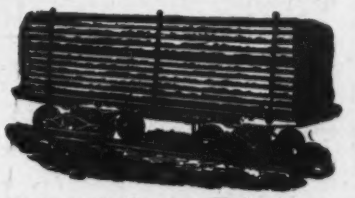

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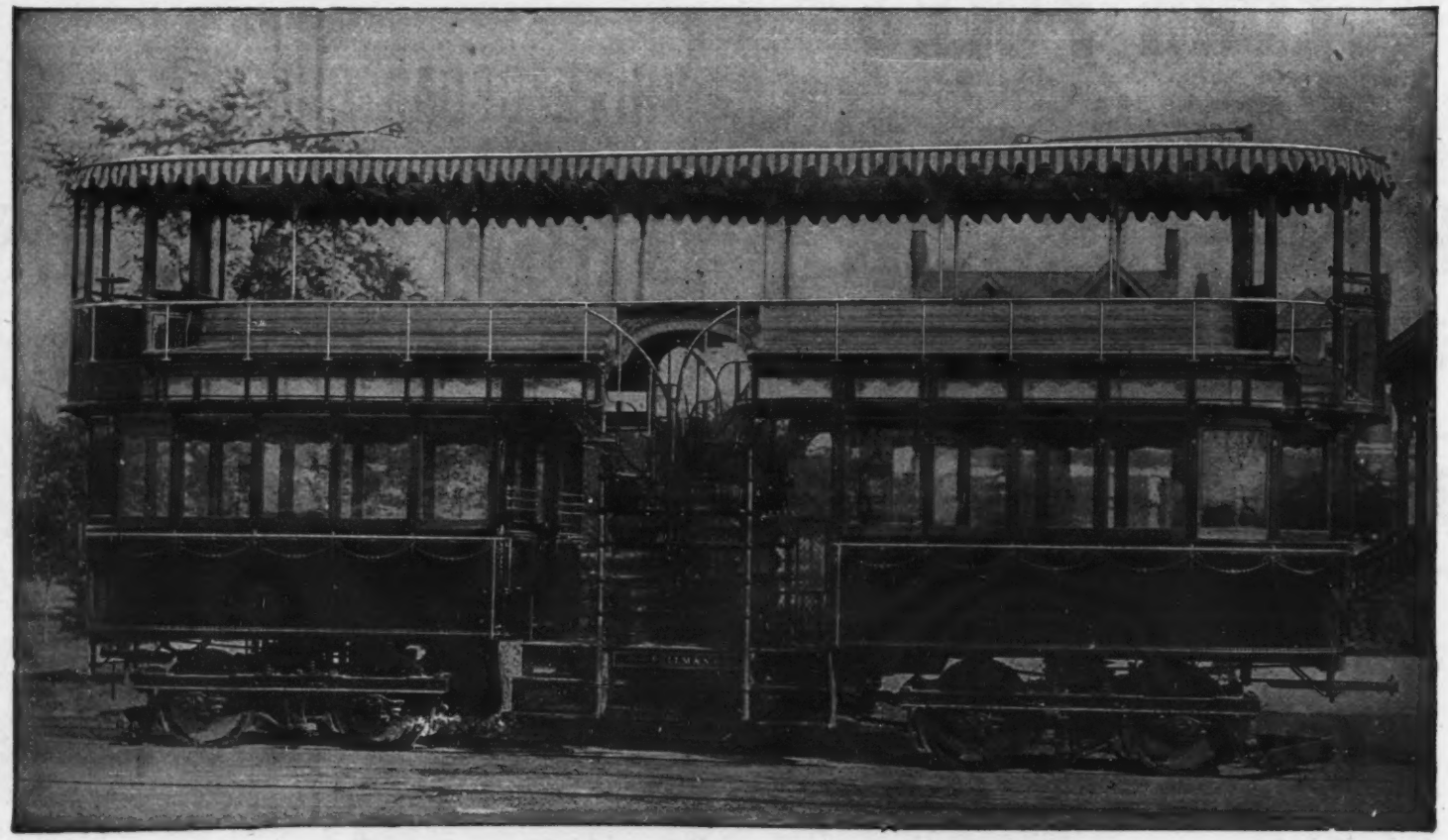

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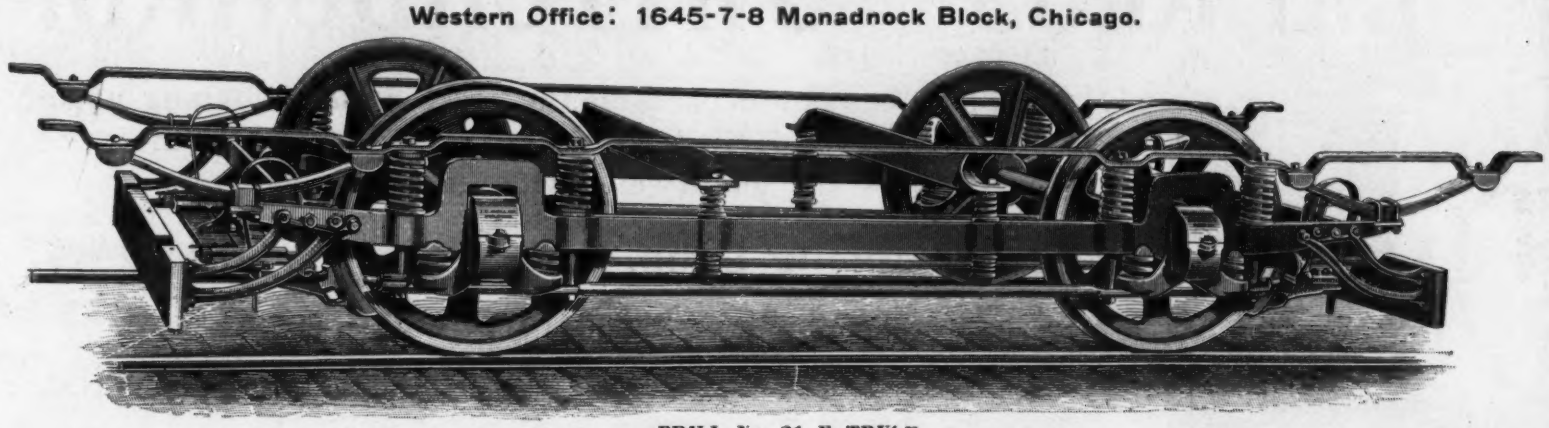

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E. J. HOUSTON, Ph.D., and A. E. KENNELLY, Sc.D.

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EDWIN J. HOUSTON, PH.D.,

AND

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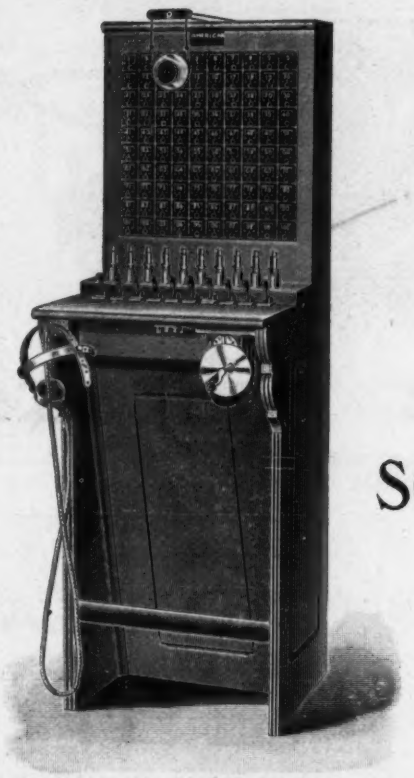

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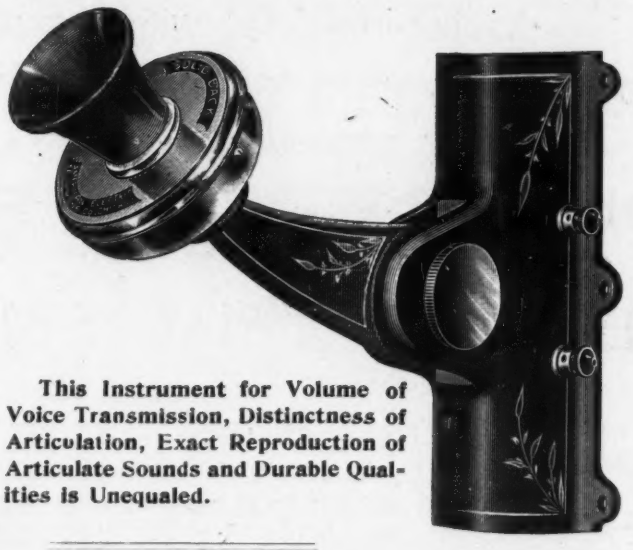

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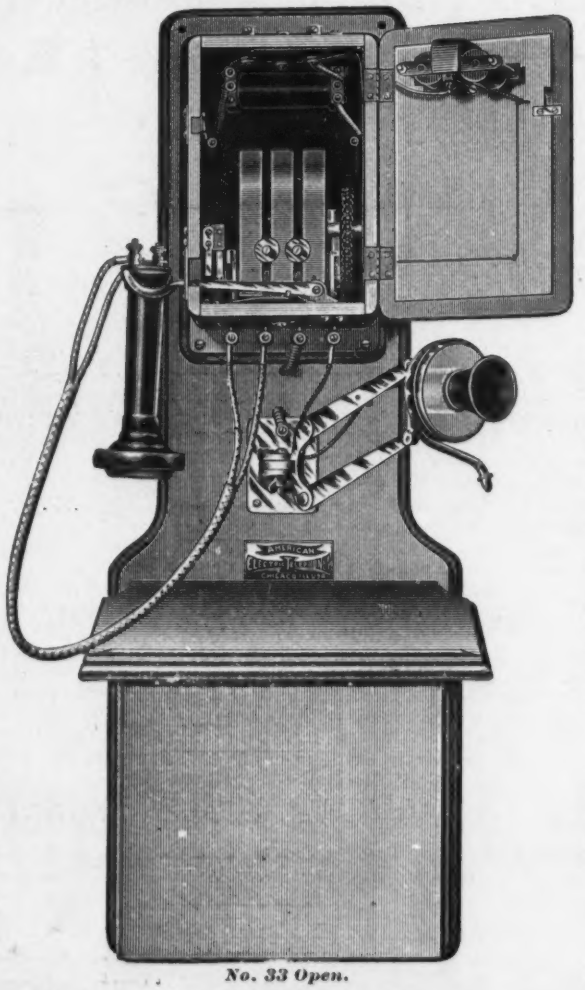

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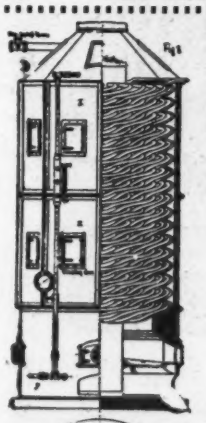

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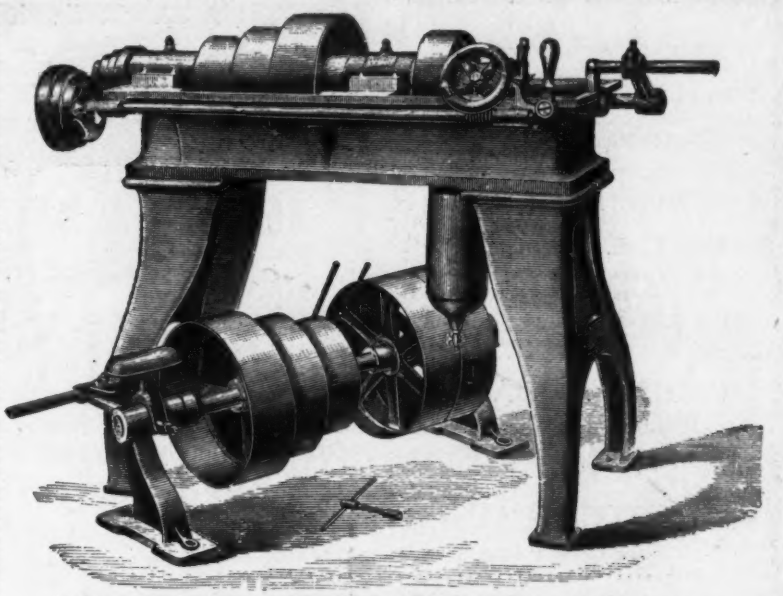

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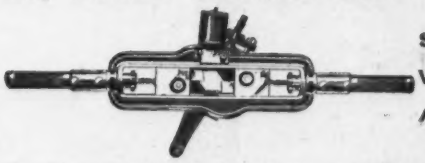

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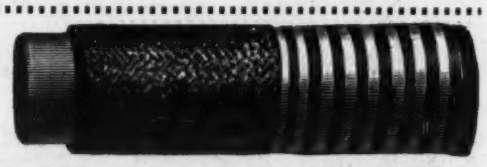

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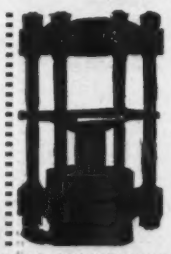

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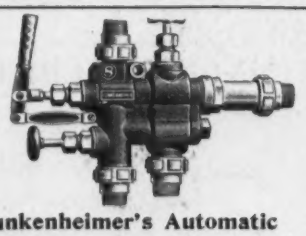

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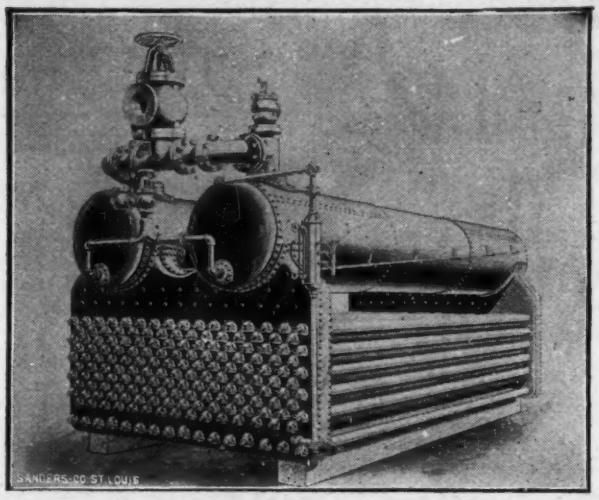

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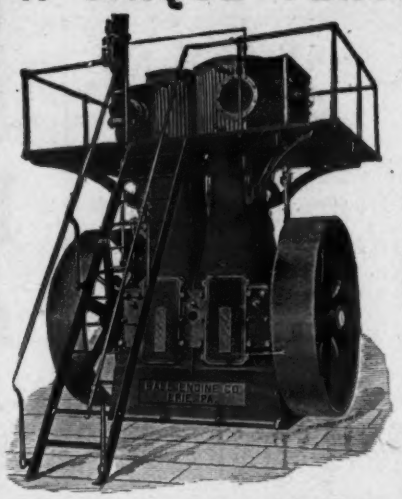

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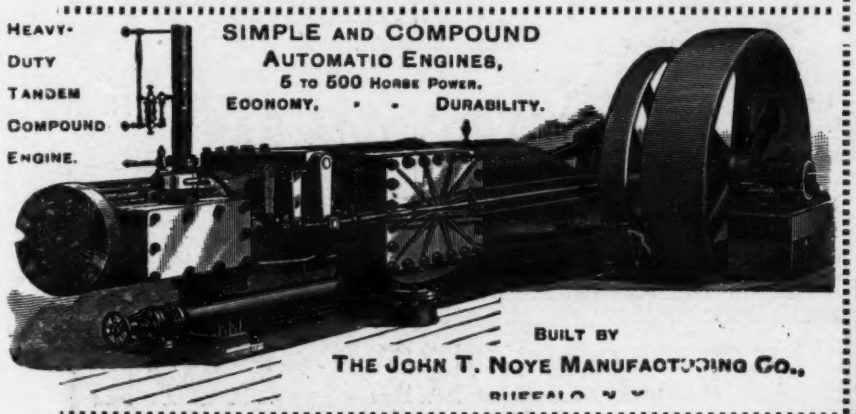

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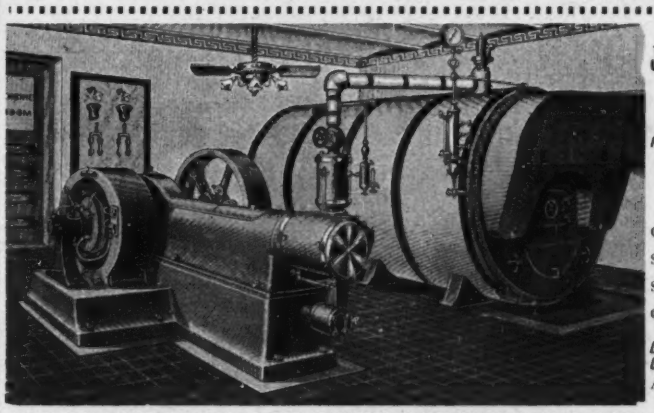

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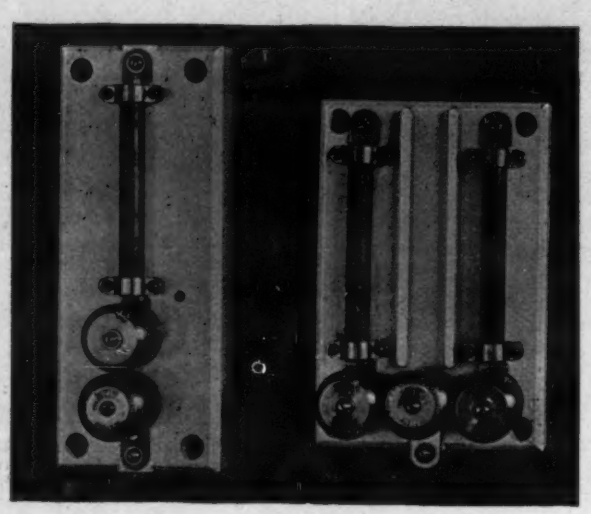

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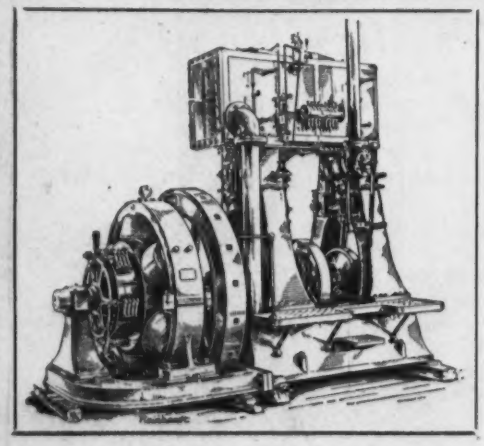

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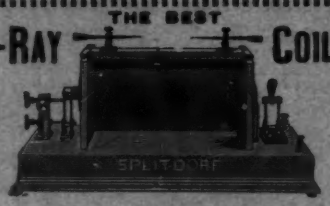

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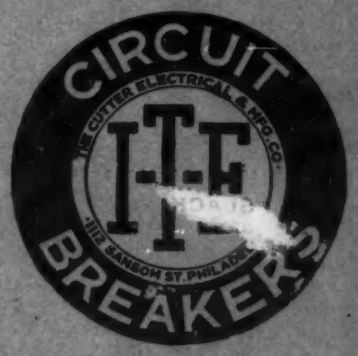

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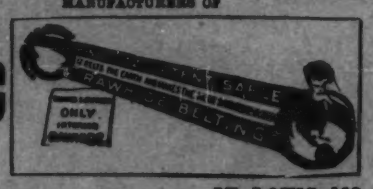

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NONE GENUINE WITHOUT SABLE STAMPED EVERY TEN FEET.
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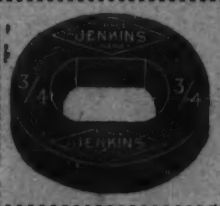

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Dynamos and Motors. Magnetic field made of one piece of forged iron. We are the only manufacturers in America of this high grade type of machine, which is superior to all others in efficiency and lower in price.
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Powers "Perfect" Arc Cut-Out.
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Rubber Covered, Weatherproof, Underground and Submarine
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C. F. CROSELMIRE,
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Uncut
Or Cut to any
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Pneumatic Bells, Pneumatic Dispatch Tubes, Mechanical Bells, Spark Coils.

EVERYTHING FOR HOUSE, HOTEL OR FACTORY USE.
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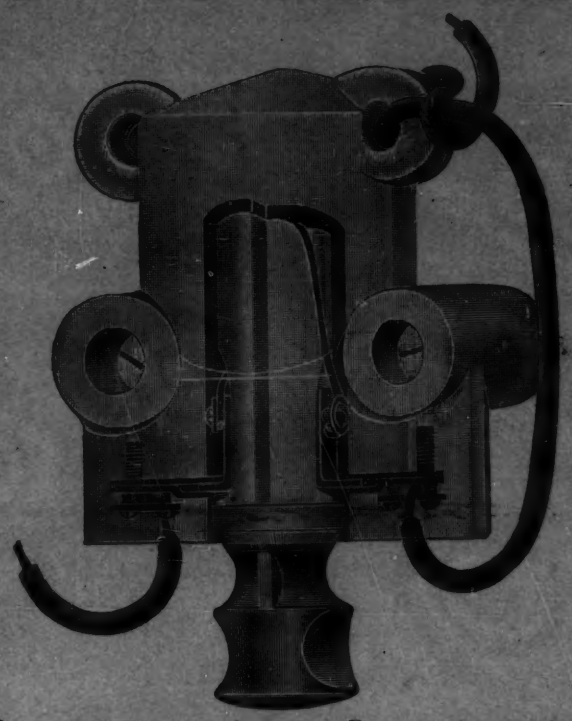
TOGGLE-CLAMP CABLE INSULATOR.

The weight of the cable in the hinged jaws causes the wire to be automatically clamped to the insulator with a powerful toggle action. No binding wires or time lost with screw caps. Lift wire in or lift it out. Attachment instantaneous—economical, simple, reliable. Perfectly insulated with Moulded Mica. Send for revised catalogue.

TROLLEY LINE INSULATORS, Etc.

Chicago. Philadelphia. Boston. London.
H. W. JOHNS MFG. CO.,
100 William St., New York.

NEW JUNCTION BOX.



Best and cheapest Junction Box on the market.
Write for circular and prices.

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RENEWED LAMPS

A good filament, a good vacuum and a thoroughly tested bulb, make our lamps equal to the best of new ones. When shipping, advise us by letter and be sure your name accompanies shipment.

LYNN INCANDESCENT LAMP CO.,
LYNN, MASS.

In Writing to Advertisers Subscribers will confer a favor on us and also on the advertisers by mentioning that they saw the advertisement in THE ELECTRICAL WORLD.

THE TOOL CATALOGUE

could justly be called an encyclopedia of tools; it is a book that every electrician or person interested in tools, supplies and machinery should have. The book is 10⅛ x 7⅛ in., contains 710 pages and over 3,000 illustrations. It will be sent with linen cover on receipt of 35 cents, or a cloth binding express paid on receipt of $1.00. The money paid for catalogue is refunded with the first purchase amounting to over $10.00. Discount sheet is sent with each book.

MONTGOMERY & CO.,
THE TOOL DEALERS. 105 Fulton St., New York City.

THE DAY LOAD

can be increased by the use of **improved electric heating devices,** which do not heat the room.

GLUE POTS, STOVES, STEW PANS,
SOLDER POTS, SMOOTHING IRONS,
HEATING PADS, CURLING IRON HEATERS,
TAILORS' and HATTERS' IRONS. CHAFING DISHES.

These and many other devices will **help you** out. Everything fully guaranteed and up to date. All dealers, or

American Electric Heating Corporation,
BOSTON, U. S. A.
Chicago, Monadnock Block. New York, 39 Cortlandt St.

We are now doing much **special work** in the way of **heating** and **special fireproof resistance** work. Have you investigated the **Universal Enamel Rheostat? The best "car heaters" in use.**

BOOKS ON ELECTRICAL SUBJECTS

mailed to any address in the world, **Postage Prepaid,** on receipt of price. Address,

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RENTED, RECHARGED, REPAIRED.
STORED ELECTRIC POWER SUPPLIED.
Portable Electric Lanterns Carriage Lamps. | Yacht Lighting a specialty.

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239 East 27th Street, New York.

NON-INFRINGING
STORAGE BATTERIES

Made of PURE ROLLED LEAD.
No Joints! No Solder! No Plugs! No Pellets!

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BUCKEYE
INCANDESCENT LAMPS.

THE Buckeye filament differs radically from any other manufactured, and yields longer life at full candle power.

THE BUCKEYE ELECTRIC CO.,
CLEVELAND, OHIO.
Monadnock Bldg., CHICAGO

Ninety-nine per cent. of store windows are imperfectly lighted, and especially so where electric lamps are used. Most of the lamps are scattered on the bottom and at the sides of the windows, where they can be seen by lookers-in, and where they attract more attention to themselves than to the goods they are imperfectly lighting. The ideal window light should light the goods, and not be seen while doing so.

FRINK'S SPECIAL PATENT WINDOW REFLECTOR is placed in top of window near the front glass, reflecting the light inward and downward. The reflectors are up out of the way and concealed from view, at the same time concealing the direct light from the eyes of the observer, and giving a strong, even light where wanted, thus doing away with the annoyance of a dazzling light in the eyes. These reflectors have been adopted by leading stores in the principal cities of the United States.

FRINK'S ELECTRIC CLUSTER REFLECTORS, with three to eight lights, have solid metal frames and are lined with silver-plated corrugated Mirror or Opal glass, in sections rigidly held in place, making them far superior to the ordinary opal reflector shades. There is no danger of the pieces breaking and falling on valuable goods or on the heads of those beneath, as with the opal shades, and now that we are able by the aid of expensive machinery to furnish them at about the same price as the ordinary opal shade they are extensively used.

No. 2509 Plain.

FORTY YEARS OF LIGHT.

No. 2505, Brass Band, Plain or Embossed.

FRINK'S PATENT REFLECTORS

Are specified by leading Architects and Engineers, and everywhere used for lighting Churches, Halls, Theatres, Art Galleries, Banks, Stores, Store-Windows, Schools, Hospitals, Telephone Switchboards, Office and Public Buildings, &c.

No. 2398.

QUALITY QUANTITY. ECONOMY.

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THE FIRST PRIZE AT THE LAST GREAT WORLD'S FAIR.

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FOR ELECTRICAL WORK.

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make the most perfect apparatus of the kind on the market.
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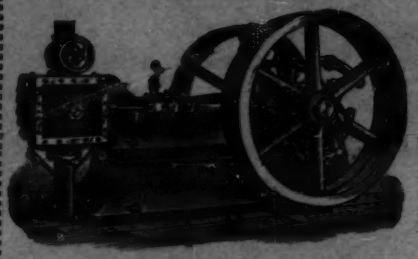
HIGH PRESSURE BOILERS, COMPLETE POWER PLANTS.
Estimates and Drawings submitted.



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Generators, Motors, Transformers, for two-phase, three-phase, and C. F. Scott two-phase three-phase system of alternating current power transmission.
36,000 horse power in oil-insulated transformers constructed.
Potentials from 5,000 to 50,000 volts. All Apparatus necessary for 100 mile transmission.

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ATLANTA, GA., Equitable Bldg.
CHICAGO, N. Y. Life Building.
PHILADELPHIA, Girard Building.
PITTSBURGH, Westinghouse Building.
ST. LOUIS, American Central Building.
SAN FRANCISCO, Mills Building.
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Woodwork for Electrical Purposes
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Black Diamond File Works.
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Special Gold Medal.

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At least three-quarters of the underground cables ordered in the United States during 1896 and 1897 are paper insulated. Our strongest endorsement is found in the fact that our competitors are endeavoring to put cheap imitations on the market. BEWARE OF INFRINGERS. If you want the best, or to learn what is the best, communicate with us.
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